Bittle

# Model Engineer

THE MAGAZINE FOR THE MECHANICALLY MINDED

## Two new ship models

FULL CONSTRUCTIONAL DETAILS INSIDE

ONE SHILLING 3 JANUARY 1957 VOL 116 NO 2902

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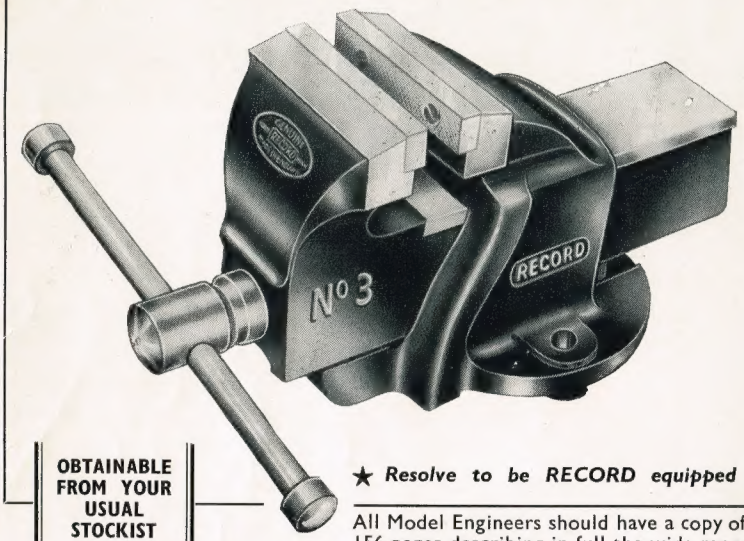


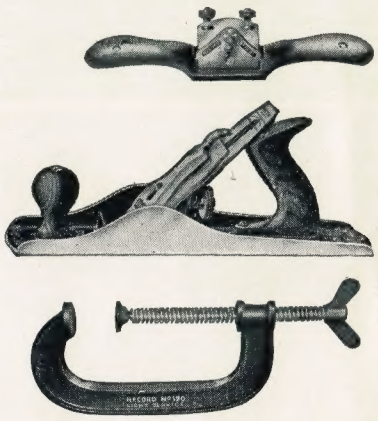

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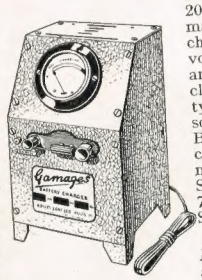


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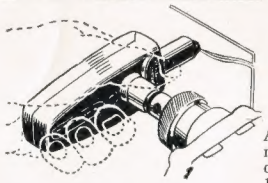

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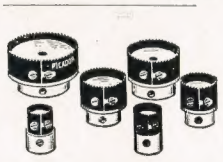

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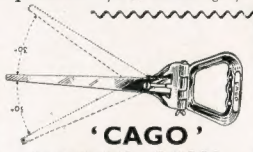

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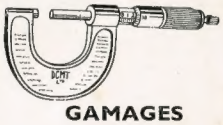

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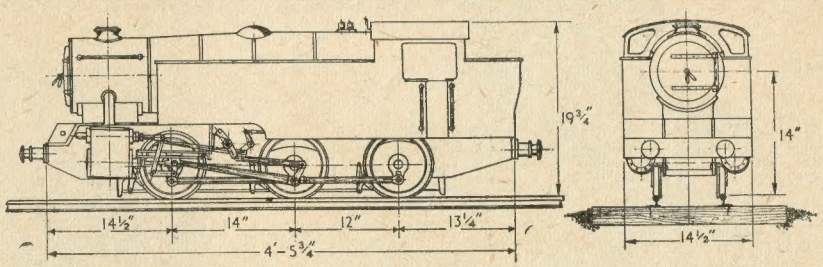


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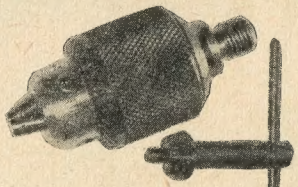

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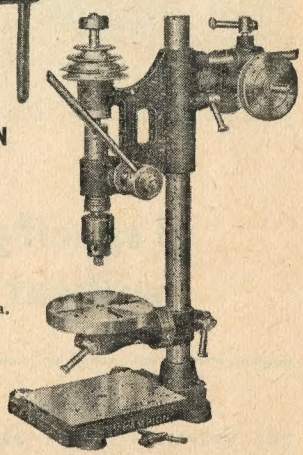

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# Model Engineer

3 JANUARY 1957 VOLUME 116 No 2902

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*Incorporating SHIPS AND SHIP MODELS*


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All correspondence should be addressed to the Editor, Model Engineer, 19-20 Noel Street, London, W.1.


# SMOKE RINGS

**A WEEKLY COMMENTARY BY VULCAN**

SHIPS AND SHIP MODELS is incorporated into MODEL ENGINEER with this issue; it ceased to exist as a separate entity after the December issue.

Perhaps, as a sitting tenant so to speak, I may first say a welcome to the new readers and to say that I believe that the staff and readers of MODEL ENGINEER will welcome this integration.

In fact some will regard it as the return of the prodigal son. It was early in the thirties that in the light of growing interest in ship modelling, it was felt that the hobby would be better served by a magazine of its own. Economically, it was never able to support itself and I doubt whether the further sub-division of MODEL ENGINEER'S interests was desirable.

Two constructional features of interest to ship modellers begin in this issue, and in every subsequent issue there will be articles that appeal to the model boat builder. Several well-known features of *Ships and Ship Models* will appear from time to time.

In welcoming our nautical friends I would like to assure them that all those who serve the parent journal are ready to fulfil their needs with the same unfailing service that the independent magazine provided.

## Oil-less lubrication

I SAW an advertisement for a German two-stroke car recently and the petroil mixture strength was quoted as 1 to 40—just half that of similar British products.

Before now I have raised my protest against the over-oiling school of thought, but I am still surprised that manufacturers do nothing about curbing this habit. Excessive oil in two-strokes (or four-strokes, for that matter) does not help the engine in any way. On the contrary, in fact, too much oil gums up exhaust ports, exhaust pipes and silencers. It causes lumpy running, clouds of smoke from the engine and an incredible amount of carbon in the engine.

## Brooklands test

During the mid-1930s a now-defunct firm of upper-cylinder lubricant makers staged a publicity stunt at Brooklands with two- and four-stroke motor-cycles. The machines were filled up with petrol—no oil at all—and some generous squirts of u.c.l. were pumped into the fuel. The machines were then driven round the track for several hours with no ill-effects.

Mind you, the stunt *was* only a stunt, because the pistons had been shaved down to give a really generous clearance and all the bearings had plenty of shake in them !

A much more impressive test was carried out—involuntarily, I might add—by a relative in 1946. He was using an autocycle to spin out the tiny petrol ration and one day he filled the tank up with a gallon of petrol, quite forgetting the oil.

# SMOKE RINGS . . .

There was something like a quart of petrol still in the tank and the machine ran on this very thin mixture for over 100 miles with no apparent ill-effects !

## " Toys that teach "

THERE are several kinds of ingenious constructional toys on the market nowadays which are claimed to be capable of providing the juvenile with education in engineering. While they undoubtedly fulfil this claim in many respects, it is important that their limitations should also be recognised by all who wish to exploit them for this purpose. In nearly all cases these toys consist of pre-formed components which can be assembled in various ways to form engineering structures and sometimes working machines.

They enable practice to be obtained in the use of simple assembly tools and furnish scope for the study of engineering structures—but only if used intelligently and with some basic knowledge of mechanical principles.

In most fields of engineering, assembly is only a small part of either theory or practice and the major application of the engineer's craft lies in the shaping of raw materials by various processes involving both hand and machine tools. Nobody would dream of trying to teach woodwork by giving students a number of pre-fabricated parts to fit together, yet I have seen constructional toys advertised as " a complete training in engineering."

I am the last to decry the solid value of these ingenious toys, which are put to excellent use not only by juveniles, but also by inventors and designers, not to mention teachers and demonstrators; but they should be kept in their due place, as serving mainly as a stepping stone to " real " engineering.

## Hand or machine power ?

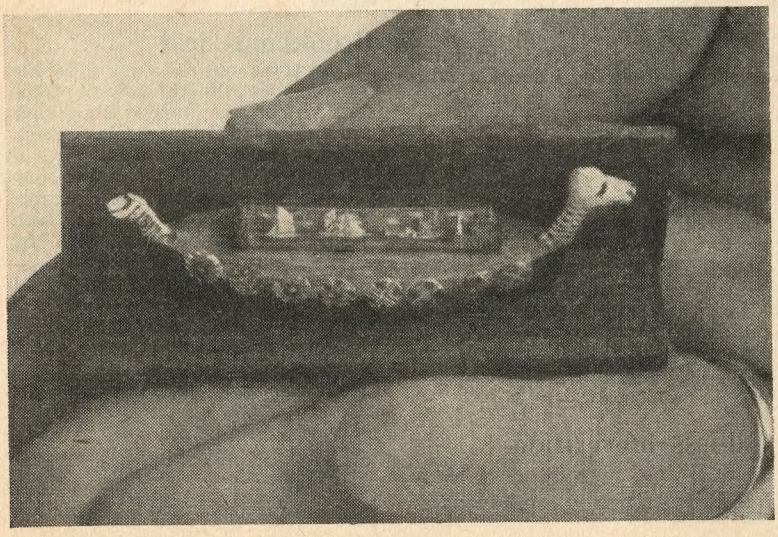
IN almost every industry nowadays manual labour is being replaced by mechanical power, and this tendency is also reflected in the amateur workshop. The availability of power tools for drilling, sawing, planing, grinding, etc., does undoubtedly speed up these operations and render them much less laborious, but some readers have questioned whether this is altogether an unmixed blessing, and whether there is not a danger of losing the ability and skill of the older forms of craftsmanship.

While there is no doubt about the advantages of using machines wherever possible in industry, where both time and skill are expensive the urgent need for them is not so apparent where the cultivation of skill to occupy leisure time to the greatest advantage is the major aim.

It would be a pity if the amateur came to rely on the machines to such an extent as to be quite helpless without them, yet there is much to be said in favour of obtaining the full benefit of modern machines and processes, which do not necessarily destroy skill but often enable it to be employed to produce better and more accurate work.

The main thing to bear in mind is that man should be master of the machine, and not its slave; and this can be assured only by applying skill and intelligence to the new developments, instead of allowing it to be submerged by them.

*Three tiny ship models, the largest barely ¼ in. long, are sealed in this fuse cartridge riding on a model Viking ship. It was sent by R. Rooney, of Exmouth*



## Cover picture

*This 9 ft 7 in. model of the giant liner* QUEEN ELIZABETH *was built by 71-year-old toolmaker William Pryor. It cost £60 and took two years to build. It was awarded a Very Highly Commended certificate at last year's Model Engineer Exhibition.*

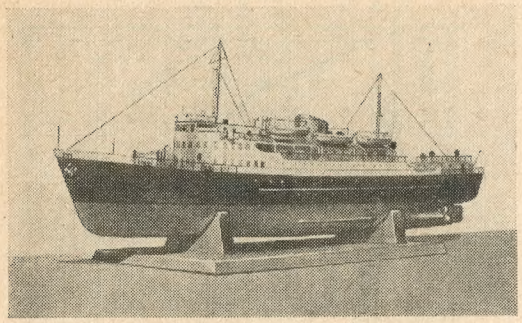
## Manual or motorised ?

While on the subject of power for machine tools, an interesting sidelight on this topic is provided by a letter from a reader who decries the almost universal " motorising " of small lathes. His main point is not so much an objection to eliminating manual work, as to put up a strong case for the value of the good old treadle lathe in teaching the beginner something about tool efficiency.

When motor power is available it is often possible for lathe users to get away with badly ground and set tools, whereas any shortcomings in this respect are very soon apparent to the operator who is obliged to supply the motive energy by his own leg muscles. As a consequence, he soon learns to grind and set tools which will cut with the least effort and thereby gains experience which leads eventually to better all-round workmanship.

There is much to be said in favour of this principle; I have often seen overworked and ill-treated lathes groaning under the load of blunt or wrongly-shaped tools which merely push the metal off instead of cutting it. A course of treadle lathe operation would undoubtedly be good for the owners of these lathes.

And by the way, the thought occurs to me—would it not be an equally good idea to make many modern motorists and motorcyclists " serve their time " on some of the very imperfect machines of the pioneer days ? Not only would they learn to drive much better but they would also, perforce, learn something about the mechanism of their vehicles and treat them with much better consideration than they do at present.



# A WORKING MODEL OF ST NINIAN

By EDWARD BOWNESS

First part of a short serial dealing with the construction of a model of a cross-Channel steamer

HAVING considered a prototype for a working model of a steamer almost instinctively one's first impulse is to model one of those glamorous ladies of the sea—the passenger liner.

The beginner thinks of the bigger liners, particularly *Queen Elizabeth*, which are so impressive whether seen at sea or in dock. But one must not forget their proportions. A model of a large liner some 5 ft long has merely 6 in. beam and a little over 2¼ in. draught, which gives a displacement of only 17 lb.

With the usual methods of construction the weight of the hull and the high superstructure might come to half that, leaving only 8 or 9 lb. for the power plant and the radio-control gear. (Radio control must be reckoned with in any modern model of a ship, as, sooner or later, the builder will want to instal it.)

**Stability difficulty**

Another difficulty with a large ship model lies in stability. The problems of naval architecture apply in a working model exactly the same as in a full-size ship. The centre of gravity of the whole structure must be located correctly in relation to the centre of buoyancy, as the vessel, be it full size or only a model, will be excessively tender and will probably capsize.

Owing to the impossibility of keeping down the weight of the top hamper to scale dimensions in a model of a large ship, some builders increase the beam and the depth to increase the displacement and to lower the centre of gravity. This produces a disproportionate model, which is certainly not "a joy for ever" when out of the water, however well it may look in action.

A better solution is to make a model of a smaller ship. Some of the cross-channel and short-sea passenger ships are just as attractive in their way as the big liners—and with their fuller proportions can be modelled accurately to scale and still be as stable and as seaworthy as their prototypes.

**Margin of 30 lb.**

As an example a 5 ft model of a ship 300 ft long, 50 ft beam and 15 ft draught would have a beam of 10 in. and a draught of 3 in., which would give a displacement of about 39 lb. The hull and superstructure of such a model would still weigh less than 10 lb.—the same as for the model of a big liner. This would give a margin of nearly 30 lb. for the power plant and radio, and a further margin for ballast.

Whether the power plant is steam, electric or diesel its centre of gravity is of necessity a few inches above the bottom of the model, but the ballast can be placed underneath all this in the form of a sheet of lead on the floor of the model. This allows considerable latitude in arranging the various weighty items of the internal gear without sacrificing strength in the more exposed parts of the model.

Another advantage of the smaller prototype is that there are fewer windows to cut out and fewer details to make. Some of these details, such as lifeboats, davits, winches, ventilators, involve wearisome repetitious work. In the model of a big liner the work seems endless, and only people of unlimited patience and perseverance are likely to complete such a model.

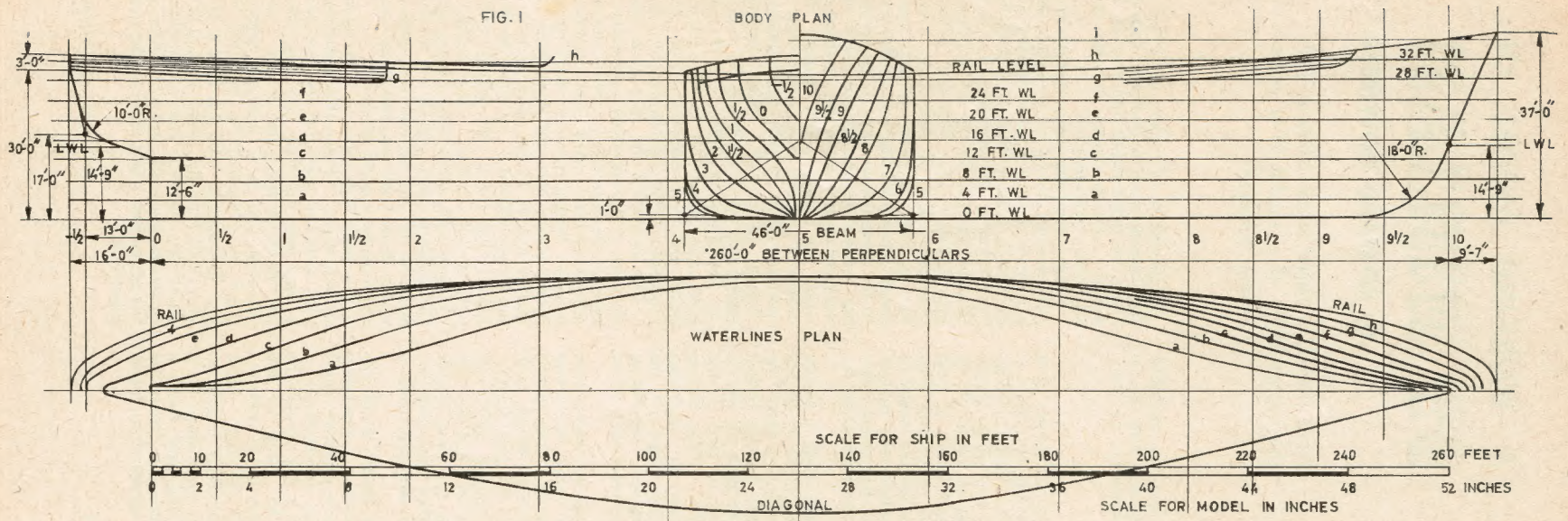
The size of the model is an important consideration. Generally speaking, the bigger a working model is made the more satisfactorily it will perform. In a big model the proportions can be those of the prototype, and there is no difficulty about buoyancy or stability. Most models look surprisingly small in the water once they move away from the side of the pond, and many a builder has wished—too late—that he had built his model to a larger scale.

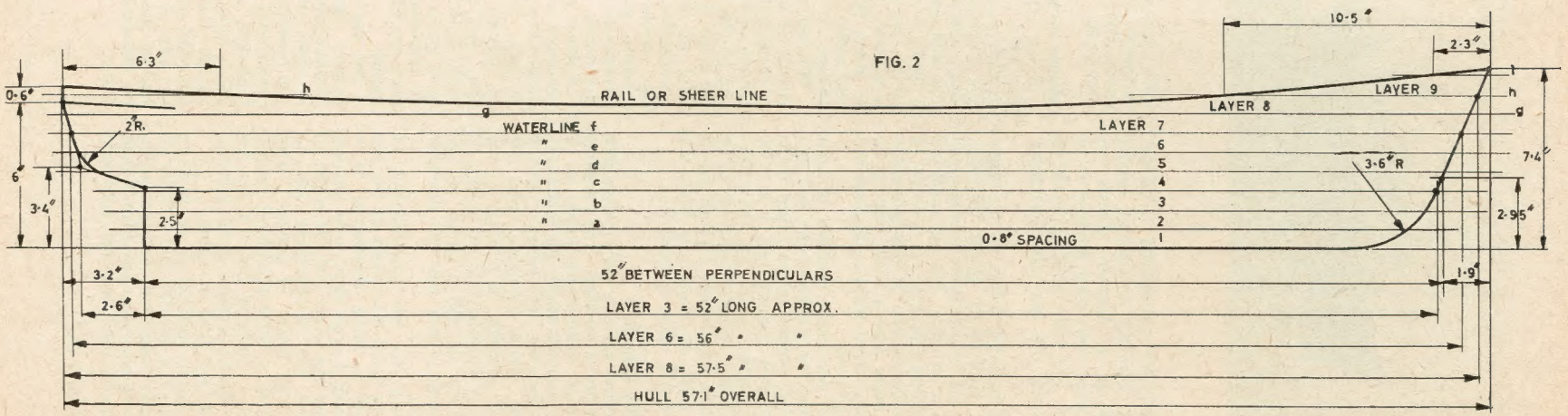
Transport is, of course, a problem, and frequently has to be the governing factor in determining the size of a model. House room is also an important consideration.

After comparing very carefully the modern examples of the cross-channel passenger steamer I have decided on *St Ninian*, a smart little ship built by the Caledon Shipbuilding Co. of Dundee for the North of Scotland and Orkney and Shetland Steam Navigation Co. of Aberdeen. She has a very modern outline and greater beam and depth in proportion to her length than any of her rivals, her draught being exceeded only by the sister ships *Arnham* and *Amsterdam* which are nearly 100 ft longer. *St Ninian* is 285.6 ft long overall with a moulded beam of 46 ft and a loaded draught of 14.8 ft. Her tonnage figures are gross 2,242 and net 1,232. At the scale of 1/5 in. = 1 ft this gives a model of 57.1 in. long 9.2 in. beam and 3 in. draught. The displacement will be approximately 31 lb.

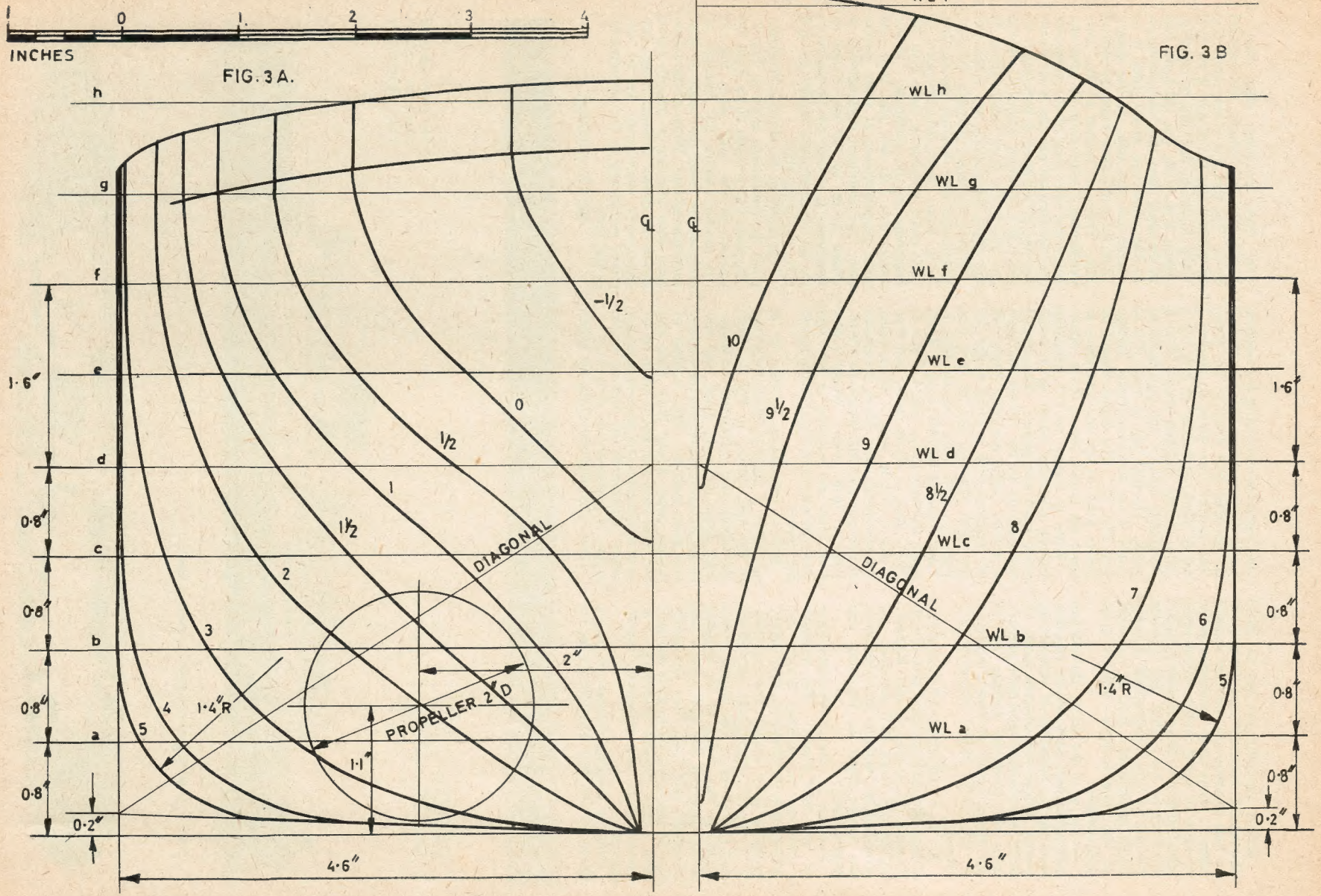
The picture of the ship gives one an idea of her pleasing appearance. She has an easy sheer, a fairly simple superstructure with the modern rounded bridge front, a short squat funnel which gives an impression of greater length to the ship, and not too many lifeboats. At the time the picture was taken the railings were covered with canvas. She operates between Leith, Aberdeen, Orkney and the Shetland Isles, one of the wildest stretches of sea around our coasts, which is in itself an indication that she must be a good sea-boat.

The hull lines (Fig. 1) will repay careful study. From the waterlines plan it will be seen that the ship has a very easy entrance and run, with practically no flat plates in her. The diagonal line is a smooth regular curve, showing that the hull will be easy for plating. The fine flare at the bows will keep her head up and the decks dry, and the easy vee-sections under the stern will give a free flow to the propellers, using them to the best advantage.




*Top, Fig.* 1: *The hull lines.* *Middle, Fig.* 2: *Profile of the hull.* *Bottom, Fig.* 3: *The body plan*


INCHES
FIG. 3A.
FIG. 3 B
h
g
f
e
d
c
b
a
1·6″
0·8″
0·2″
4·6″
-1/2
0
1/2
1
1½
2
3
4
5
DIAGONAL
1·4″R
2″
PROPELLER 2″D
1·1″
WL i
WL h
WL g
WL f
WL e
WL d
WLc
WL b
WL a
10
9½
9
8½
8
7
6
5

Before actually starting to build the model, materials and the method of hull construction must be decided upon. Many ship modellers prefer to work in wood, but in recent years metal hulls have become more popular, particularly now that the tinplate method of hull construction is being better understood. And for a model of this type a metal hull is more appropriate.

So far as I am aware the tinplate method of hull construction was first used by Dr Stansfeld of Angmering, Sussex, whose true-to-scale model of M.V. *Port Brisbane*, and more particularly the dramatic sinking of his S.S. *Egypt* model, created a sensation in the 1951 Model Engineer Exhibition.

Mr F. C. Chapman of Heathfield, Sussex, demonstrated tinplate hull construction at several Model Engineer Exhibitions from 1951 onwards and described his methods in *Model Ships and Power Boats* in February and March, 1952.

Norman A. Ough's tinplate hulls are also well known. His valuable article on the subject which was published in the Wembley Ship Model Society's *Sheet Anchor* and reprinted in a special supplement should be read and studied. The feature of the system is that owing to the thinness of the material the hull comes out extremely light, and thus the model may be made strictly to scale and still have ample reserve buoyancy. A wooden hull is, relatively, much heavier.

First, a wooden former the exact shape of the hull must be made, so that when the hull plating is assembled on it the completed hull will be true to the lines laid down in the plans. The former may seem to involve a lot of work, especially as it is not a part of the finished model, but if accurately made it will save hours of work. The best way to make it is to build it up bread-and-butter fashion (see Fig. 2). The layers should be 0.8 in. thick to suit the waterlines, as these are drawn 4 ft or 0.8 in. apart.

What is known as 1 in. planking usually measures about $\frac{13}{16}$ in. thick when sawn and planed. This should be trued up to the correct thickness of 0.8 in. Eight complete layers will be required with a small wedge for the stern and two for the bow (see Fig. 2). The lower layers, Nos 1, 2 and 3 should be 52 in. long × 9½ in. wide, the next three, Nos 4, 5 and 6, 56 in. long × 9½ in. wide, and Nos 7 and 8, 57½ in. long × 9½ in. wide. An additional layer, No 9, is required at the bow and this should be 10½ in. long × 7½ in. wide. Wedge pieces ½ in. thick are required at bow and stern, as shown in Fig. 2, to complete the sheer.

Before proceeding further it is advisable to make a full-size drawing of the hull, similar to Fig. 1. This will enable you to trace off the waterlines direct on to the wood, and also to get the correct outlines for the bow and stern profile. Take a sheet of tracing paper about 18 in. wide and 5 ft 3 in. long and pin it down on to a smooth surface. (A piece of cartridge paper underneath the tracing paper makes it pleasanter to work on.)

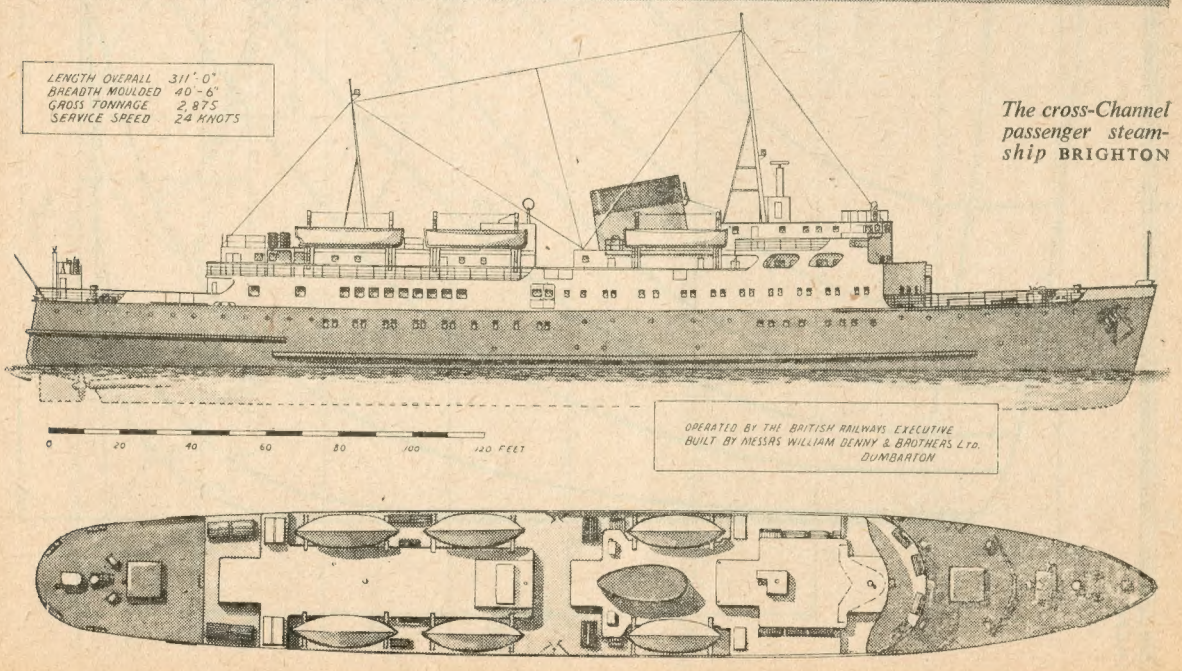
Draw a straight line along the paper 2 in. from its lower edge and a second line 7 in. above and parallel to it. The first line is the centre line of the hull and the second is the keel which forms the base line of the ship. About 6 in. from the left-hand end of the paper draw a line at right angles to the other two and extend it to almost the top edge of the paper; 52 in. from this draw a second vertical line. These are known as the "perpendiculars" of the ship, the after one being the after face of the sternpost and the forward one the point where the line of the stern is intersected by the L.W.L. or load waterline. These are the points from which many of the ship's calculations are measured.

Divide the space between the perpendiculars into 10 equal spaces, each 5.2 in. long. Erect perpendiculars at each point, numbering them 0 to 10, beginning at the sternpost. Bisect spaces 0-1, 1-2, 8-9, and 9-10 and erect perpendiculars at these points also. An additional perpendicular is drawn 2.6 in. aft of line 0 and is numbered ½. These are necessary as the hull form changes rapidly toward each end of the ship.

The profile of the ship can be drawn from the dimensions given in Fig. 2. The sheer line is taken direct from the sections in the body plan, Fig. 3, the position above the baseline at each section being the height of that particular section. When all the points have been obtained a smooth curve should be drawn through them, any discrepancy there may be in the points giving way to the smoothness of the curve.

●*To be continued.*

## ship shapes


LENGTH OVERALL 311'-0"
BREADTH MOULDED 40'-6"
GROSS TONNAGE 2,875
SERVICE SPEED 24 KNOTS
0 20 40 60 80 100 120 FEET
OPERATED BY THE BRITISH RAILWAYS EXECUTIVE
BUILT BY MESSRS WILLIAM DENNY & BROTHERS LTD. DUMBARTON

*The cross-Channel passenger steamship* BRIGHTON

# The M.E.

# MUSICAL CLOCK-8

## By C. B. Reeve

**Details of the vertical fly and the musical barrel are given in this week's article**

*Continued from 20 December 1956, pages 870—873*

FIG. 28, Nos 1, 1a, 1b and 1c give the details of the vertical fly. A vertical fly runs more easily and is quieter than a horizontal fly, so it is more suitable for a musical train.

It is constructed in a similar way to the chime fly, but the dimensions are somewhat different. The pinion head is B gauge drill size, or 15/64 in. dia., and it has eight leaves. Nos 2 and 2a show the upper cock or bracket of the fly, which is positioned and screwed to the outside of the back movement plate.

There is a small end-plate of hardened steel screwed to the under side of the cock on which the end of the lower pivot of the fly arbor revolves.

### THE MUSICAL BARREL

Fig. 28, Nos 3, 3a and 3b give the details of the musical barrel and its gearwheel. This wheel is $\frac{1}{2}$ in. wide and is the same diameter as the second wheel of the train and contains the same number of teeth, being cut with the 40 d.p. cutter in order to lighten its weight. A recess or sink is turned from its outer side. This recess is indicated in No 3b, shown in dotted lines in the drawing.

The chime barrel arbor is made from a length of silver steel $\frac{1}{4}$ in. dia., and has the chime wheel fixed to it by way of a collet, but instead of riveting it to the collet it is a nice push fit, retained in place by a small screw in the junction of the wheel and collet. This can be seen in 3a.

The musical barrel itself is built up from a length of $2\frac{5}{16}$ in. dia. brass tube and has circular brass discs soldered to each end of the tube. It is preferable, though not essential, to turn a small recess in the thickness of the wall at the ends of the tube for the brass discs to bed against, and a three-point steady is the lathe fitment to use for this operation.

The two discs must not be an absolutely tight fit. Room must be left for the soft solder. A good way to do the soldering is to flux and position the disc in the end of the tube and stand the latter on end and place three small pieces of solder at the appropriate positions, then heat up the tube with the Bunsen burner held in the hand.

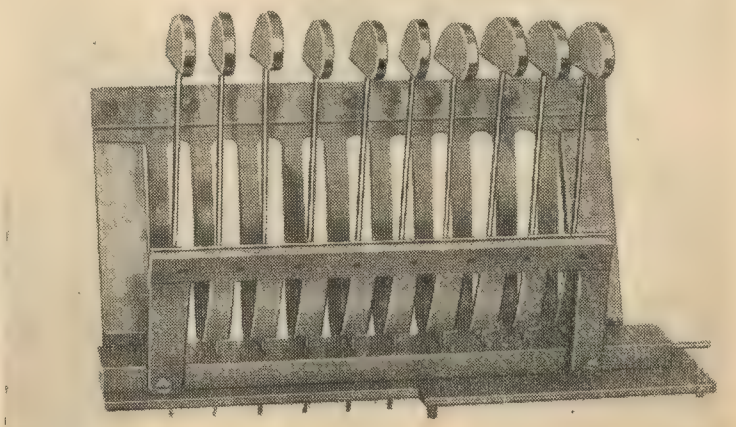
A good general heat applied near the business end of the tube will cause the solder to flow around like water. The holes in the centre of the discs can be bored before soldering. It should be noted that one disc has a set collar fixed to it. It is riveted to the disc before the soldering operation.

Next a turning mandrel should be prepared. A length of $\frac{1}{4}$ in. dia. silver-steel rod is centred at each end and the barrel is now clamped to the mandrel by the binding screw in the set collar. The barrel is turned true all over between lathe centres. Light cuts with a knife tool will be necessary for this procedure, as the brass tube will have a tendency to chatter. It took the writer three hours to turn down the tube true and polish it!

The barrel is a push fit on its arbor and is not fixed by any screws to the chime gearwheel; it is clamped to the arbor by the binding screw in the set collar attached to the disc at the end of the barrel. The reason for this will be explained later. This then completes the musical train, which should now be pivoted and run on the movement plates.

To get the depthing correct between the contrate warning wheel and the fly pinion may appear a bit of a problem. But if the bottom cock or bracket that carries the pivot of the fly arbor is clamped temporarily to the inside of the back movement

*Hammer rack and springs of musical train*



plate, the position of the pivot hole can be roughly estimated by eye, and should be marked a little too much in mesh.

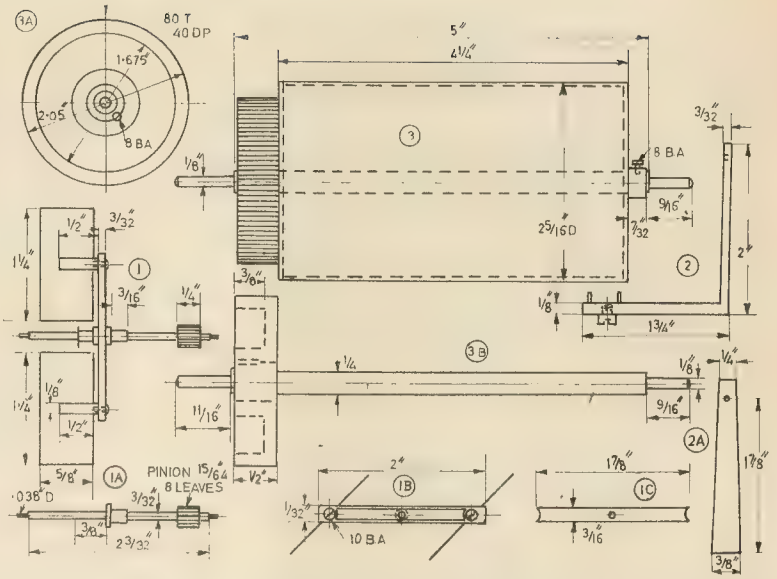
After drilling the pivot hole the back of the cock that fits against the back movement plate can be reduced by filing. If this is done gradually, a perfect depth will be the result. It will then be easy to get the position of the upper pivot of the fly with the top cock by measuring off from the lower pivot hole. The fly arbor must have a little endplay.

Fig. 29 shows a side view of the musical train between the plates, but the musical barrel is not in position. The hammer rack shown broken in the drawing belongs to the chiming train. It is depicted here to show the relative position of the hour hammer and the large hour bell.

Fig. 30 is the same view with the musical barrel in position. This drawing also shows the musical hammer frame in position.

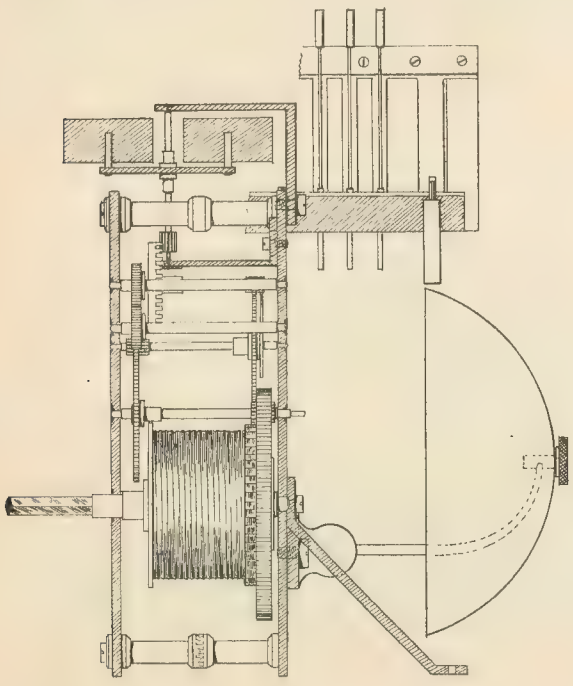
Fig. 31 shows a front view of the musical train. It should be noted that the second wheel of the train drives the cam-wheel pinion and also the first idler. This idler drives the second idler, which in turn drives the gearwheel of the musical barrel arbor.

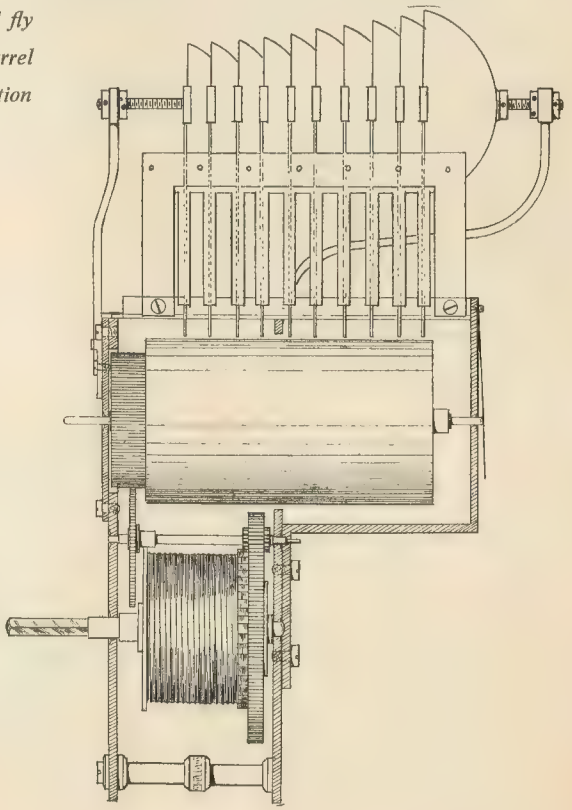
In Fig. 31 will be seen details of the bottom cock of the vertical fly. When finally fitted, it should be screwed and steady-pinned to the back movement plate. The front pivot of the musical barrel arbor runs in a vertical brass strip attached to the front plate. When finally fitted it should be screwed and steady-pinned to the front movement plate. The back pivot of the musical barrel arbor runs in a large cock which is screwed and steady-pinned to the back movement plate in a similar way as the chime barrel arbor.

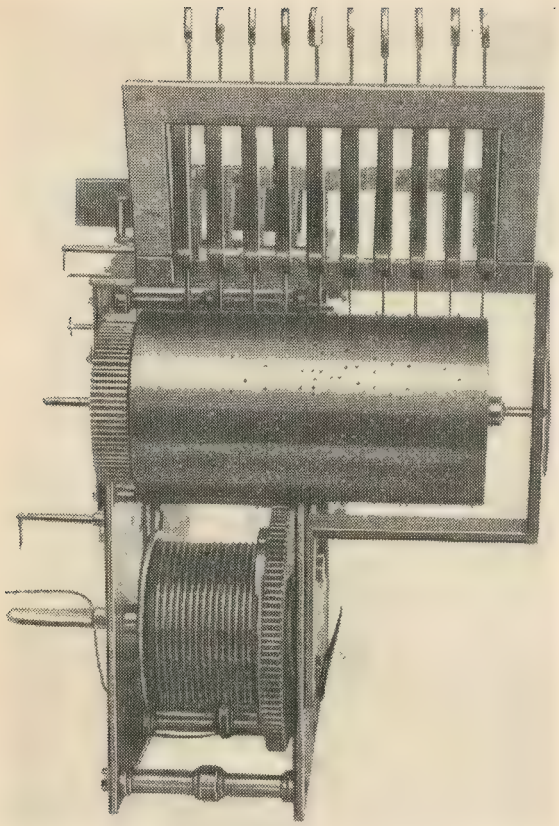


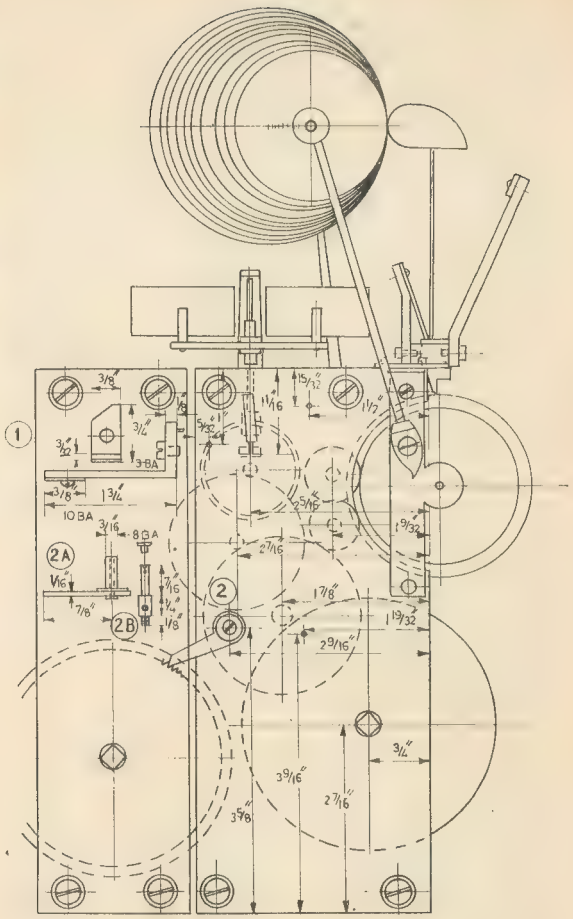

*Above, Fig.* 28: *Working drawings of the musical barrel and fly*

*Below, Fig.* 29: *Side view of the musical train with the musical barrel removed. Right, Fig.* 30: *Side view with the barrel in position*










*Above*: *Musical train with the barrel in position*

*Right, Fig.* 31 : *Front view of the musical train*

Details of the brass strip and the cock are given in Fig. 32, Nos 1 and 1a for the former, and Nos 2 and 2a for the latter. The cock should be built up and the joints silver soldered to make a strong job. No 3 is a steel spring, the upper end of which is screwed to the top of the cock. Its purpose is to keep the back pivot of the barrel arbor pumped in the direction of the front movement plate.

There is a lever on the front movement plate which controls the position of the pivots of the arbor, and with it the musical barrel itself between distance apart of the two movement plates. This movement of the barrel is required for the changing of the tune to be played, and will be explained later.

About half the width of the cock is proud of the side of the back movement plate. This is shown clearly in Fig. 32a, which shows the complete view of the back of the movement. This concludes all the internal work of the movement, except the maintaining click.

This item is seen in Fig. 31, No 2 in position. The point of the tip of click is in one of the maintaining ratchet wheel teeth. Its stud is screwed to the inner surface of the back movement plate, and Nos 2a and 2b give details of its construction.

There remain the two hammer racks to make, and also the various levers and other parts situated on the outside of the movement plates.

## CHIMING HAMMER RACK

Fig. 25, No 1 shows this fitment in position on the movement frame, and No 2 gives details of dimensions. A plan view from above is also shown in Fig. 26, No 1.

The rack itself is made from a piece of brass $\frac{3}{4}$ in. wide × $\frac{1}{2}$ in. high, and approximately 5 9/32 in. in length. The first thing to do is to produce a small hole, say $\frac{1}{16}$ in. dia., from end to end in the brass block. This hole accommodates a long pin which locks all the hammers in their respective slots.

The way to make this hole is to mill a long groove from one end of the block to the other. A small circular saw does this very well. If there is no means of milling this in the lathe, it can be accomplished with a hack saw instead. Next, a strip of brass is then filed to fit in this groove but before soft soldering the strip in position, the long pin should be greased and put in position in the bottom of the groove. The strip of brass is then placed in position and fluxed.

Lay the block on a brick and heat up well with the Bunsen burner. The solder must be made to flow from end to end of the brass strip, and also on both sides of the strip. Before the solder cools off, the pin should be kept moving in case any solder has leaked through the bottom edge of the strip and soldered the pin to the groove.

After this operation, the block should be thoroughly washed in ammonia and water and well dried over the Bunsen burner.

Now mark out the positions of the slots that the hammers function in. The width of the slots is $\frac{1}{16}$ in. The slots are best cut with a circular

saw of this width, either in the lathe or milling machine if available. However, if this is not possible the slots can be cut with a hack saw and finished with a file of suitable width.

As it is almost impossible to file absolutely flat, it is advisable to place the block between two pieces of wood which have previously been slotted. By this means the file will be kept from wobbling. It is most important that the sides of the slots are produced true and flat, otherwise when it comes to fitting the steel hammers they will wobble when being moved by the pins in the barrel.

The slots are cut about $\frac{7}{16}$ in. deep and it will be seen in Fig. 25, No 2 that there is a strip of thin metal (it can be either brass or steel) screwed to the top of the block. The front edges of the hammers butt against this strip after they have been released by the pins on the barrel.

As this strip covers part of the length of the slots, the hammers can swing backwards but are checked by the strip when they reach their normal resting position. The hammer shown in the extreme left hand slot (Fig. 26, No 1) represents the hour hammer as viewed from above. This hammer is again seen in Figs 25 and 32a.

## MAKING THE HAMMERS

The next thing to do is to make the eight chiming hammers and the hour hammer. A side view of the former is shown in Fig. 25, Nos 2 and 2a. The parts that work in the hammer rack are made from mild-steel plate $\frac{1}{16}$ in. thick.

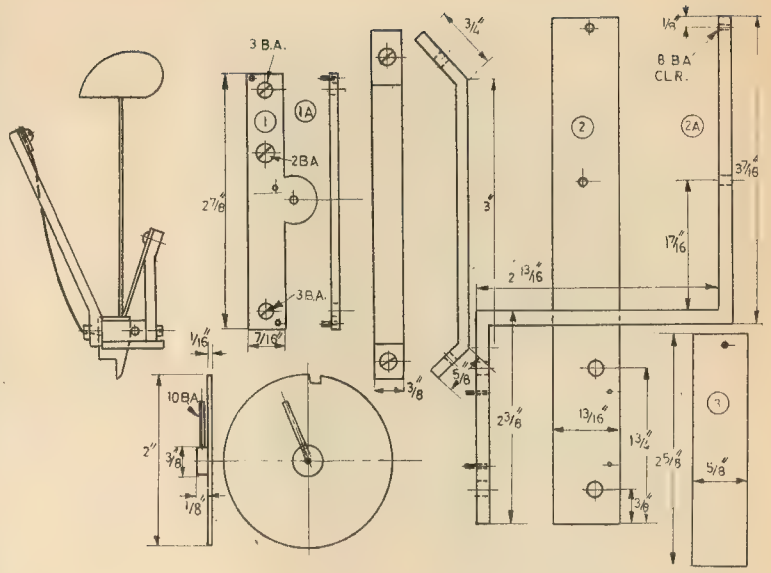
They should be cut out with a fretsaw and after the hole for the pin has been drilled they should all be assembled on a spare piece of pin and clamped in the vice and all their respective edges filed up together. This will ensure their being of equal dimensions. They should now be finished with emery sticks.

The top edge of each hammer is drilled and tapped 12 B.A. This requires care to avoid breaking through the thickness of the hammer with the drill.

Procure some mild-steel wire, about 12 B.A. diameter, and cut the eight hammer stems. A 12 B.A. thread is cut at each end. One end should be firmly screwed into the previously tapped hole, taking care not to break the stem off.

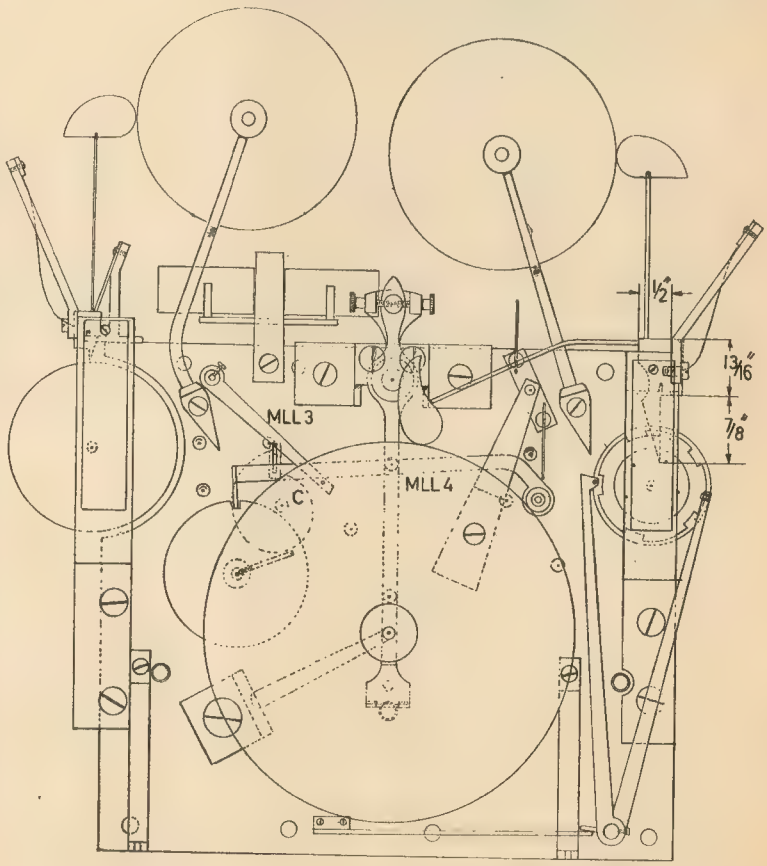
The hammer heads are made from $\frac{1}{8}$ in. brass plate. They are cut out with the fretsaw and will require fine finishing and polishing. They are drilled and tapped 12 B.A. and screwed on to the other end of the hammer stems.

● *To be continued.*



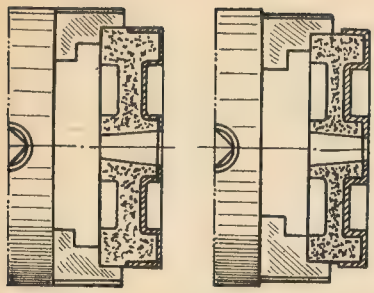

*Above, Fig. 32: Various details of the musical train*

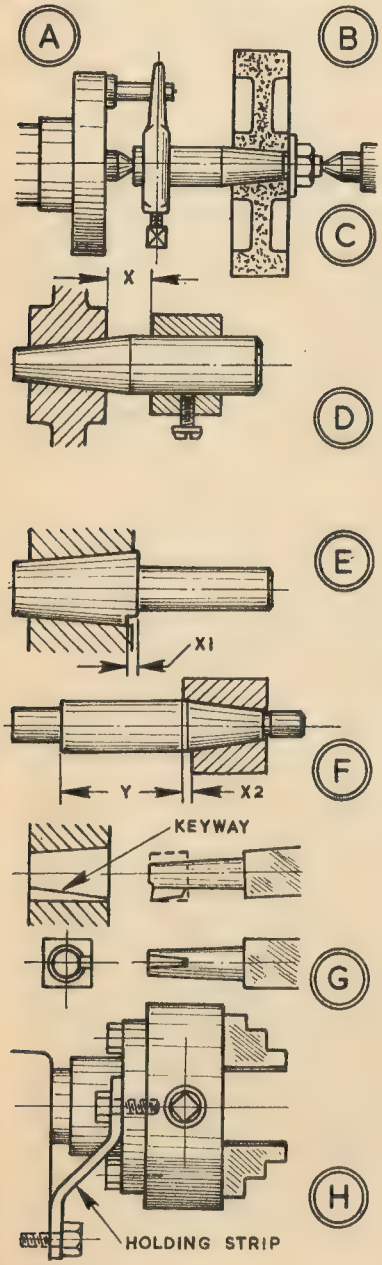
*Below, Fig. 32a: View of the back of the movement*



# TAPERS

**GEOMETER gives a few hints on machining and checking**






THE DESIRABLE true running of a pulley or flywheel taper-fitted on a shaft is generally best ensured by finishing faces and outside diameter with the component mounted on a mandrel running between centres in the lathe. All important surfaces are thus finished at one setting and the wheel is both parallel and concentric—a condition difficult to achieve by chucking and re-chucking no matter how carefully this may be done.

The preliminary roughing out is advisedly done in a chuck (which can be a four-jaw independent type with the jaws reversed if necessary, since heavier cuts can be taken in a chuck than on a mandrel) leaving about 1/64 in. surplus for finishing. In this way, scale or any hard spots in the casting can be successfully dealt with in the rough machining, using a slow rotational speed and taking cuts deep enough to be everywhere well below the surface.

Diagrams *A* and *B* illustrate typical chuck set-ups for rough machining a small flywheel, the material removed at each being shown by the shaded areas. At each set-up the wheel is pushed back to the jaws for facial alignment, and the jaws are regulated for peripheral or general spinning truth.

Although it is not vital to do so, it is generally best to machine the taper bore on the first set-up, and also to turn along the outside diameter as far as possible. On the second set-up it is then practicable to fit a taper mandrel in the bore and employ its end for checking and truing—if it should happen that it is difficult to apply the pointer of a surface gauge to a portion of the outside diameter.

Moreover, should a small error result from the setting, cleaning cuts can easily be taken on the mandrel set-up *C* since the particular faces will be towards the tailstock.

## TAPER UNIFORMITY

When the shaft is available on which the wheel is to fit, it can be tried in the taper as this is machined (or reamed) in order to locate the wheel endwise correctly—in which respect, should the taper bore be made slightly too large a reducing cut can always be taken over the face.

Alternatively, the bore can be sized from a reamer or mandrel, as at *D*, which may be necessary if the component is a replacement, or one is requiring to standardise tapers for wheels to be fitted on different shafts. In the case of a mandrel, a shoulder can be left in machining or a sleeve can be fitted for a distance *X* to obtain when the taper is at correct size; in the case of a reamer, a sleeve is essential when the distance can be measured with a rule, or a small gauge made just to push into the space.

A common type of gauge for this method of sizing tapers is as *E*, where the taper portion ends in a step on one side *X1*. On the tool being pushed tightly into the bore to be tested, the step should go just below the surface while the full diameter just stands proud—showing the bore to be within its particular tolerance.

Should the gauge enter too far a light correcting cut can always be taken across the face—assuming there remains sufficient material on other faces to machine them into relationship—which is as good a reason as any for finishing the taper early in the proceedings.

The principle also applies to a shaft *F* where a ring gauge (corresponding to the component) is used. This may have a step *X2* to locate the position where the taper finishes at the full diameter, or at the opposite end on the small diameter, though a better way is to take the distance *Y* from the face to a shoulder or the end of the shaft.

If a keyway is required in a wheel its cutting should be the final operation. From square silver steel a tool is made as *G*, turning the shank, filing the surplus to tool shape, then hardening and tempering. Planing cuts are taken from the saddle with the chuck secured against rotation, as at *H*, by a holding strip from backplate to headstock. ▣

# PLASTICS in model engineering — 13

*Continued from 20 December 1956, pages 884—886*

By EDGAR T. WESTBURY

IN THE ACTUAL TECHNIQUE of reinforced plastics construction, the first consideration is the production or preparation of an original or "pattern" model, whether it is to be used as the actual mould or to produce a female mould.

If a suitable model of a shape that does not introduce difficulties in withdrawal, etc., is already in existence, the amount of preliminary work to be done is much reduced, but more often than not, especially in creative work, the model must be specially constructed and it is therefore necessary to investigate ways and means of finding the simplest methods that will produce the desired results.

The particular facility of this method of producing objects with compound curvature and complex shapes which are difficult to produce by other means should be exploited to the full, and the art of the sculptor may be found extremely useful both in visualising and producing these three-dimensional forms.

Objects in low relief present, perhaps, the simplest problems and are suitable exercises for the beginner. It is possible to work from a hard wax or Plasticene impression built up on a flat plate, such as a sheet of plate glass. With the latter material some care is necessary in the initial stages of building up the laminate owing to the soft nature of the surface, but once the initial layer has been applied and has set fairly hard the risk of deformation is almost entirely eliminated.

Both wax and Plasticene can be used for one-off jobs where undercuts are involved, as the "model" can be melted or dug out after forming the laminate. For more permanent models, however, plaster or other hard-surfaced material, including cast resins such as Catalin, have obvious advantages.

These principles apply to all types of pattern models however complex or intricate and whatever the size. The model needs only to be strong enough to stand the application of the first layer of cloth or chopped fibre mat, and many successful jobs have been done on cardboard or balsa wood foundations; it is essential in all cases, however, that adhesion to the model be prevented by applying a parting or "release" agent.

## CONSTRUCTION OF PATTERN MODELS

Among the likeliest objects to be undertaken by the amateur are boat hulls or car bodies; whether these are in full size or miniature the same general methods apply, though in making first experiments it is well to work on a small scale if only to reduce expense, particularly if complete success is not immediately attained. Of the two items mentioned a boat hull

## Making moulds for glass-fibre fabrication

is generally the simpler of the two, as it is generally possible to fabricate it in one piece. A car body of modern design, however, usually involves more complex curves and undercuts which need special treatment.

Assuming that it is not convenient to carve out a solid model, an "egg-box" type of frame may be built up by assembling longitudinal and cross members cut to templates conforming with the contours of the design. For this purpose, metal, plywood, or even stiff cardboard can be used. In the case of a small model, the simplest way to fill in the "cells" of this structure is by means of plaster or modelling clay, the latter being easiest to fair off into smooth flowing lines, though the result is more liable to subsequent deformation than plaster.

Large models may be covered with wire mesh followed by a layer of blanket or felt, preferably consolidated and faired off with a coating of plaster of a sufficient thickness to provide rigidity; this enlargement of the overall dimensions of the model must be allowed for in making the frames or formers. When the model is finished to complete satisfaction it should first be given a coat of shellac varnish to seal the pores of the plaster and then treated with a suitable separating agent. For the Bondaglass process, spraying with cellulose acetate, followed by polishing with a good wax polish, is recommended to prevent adhesion of the resin to the mould.

The methods of building up the laminated glass-fibre structure, as described in the previous article, apply to most of the proprietary processes, including Bondaglass, except for minor details which are specified in instructions supplied in particular cases. When fabricating the final object direct from the external mould care is necessary to avoid roughness and uneven thickness of the layers which can cause unnecessary work in sanding down the surface.

### Getting smooth finish

It is possible, however, to smooth off minor irregularities by finishing with a layer of linen, and the use of a plastic filler, such as Bondafiller, applied with a palette-knife helps in the production of a smooth surface which, after rubbing down with "wet-and-dry" abrasive cloth, forms a foundation for painting by brushing or spraying.

The advantages of female moulds have already been discussed, and for some classes of structures they are practically a necessity. A single-piece shell produced from the model by plaster casting is suitable for many small objects which do not involve undercuts, but in other cases it may be found necessary to make the mould in sections which can be assembled in correct relative positions to enable the object to be fabricated in one piece. They can be dismantled for its removal.

It is necessary to decide at what points the mould should be divided to enable the individual sections to be withdrawn easily. Lines should be drawn on the model at the separation points; in some cases simply splitting the mould in the centre is sufficient, but very often three, four or more parts may be necessary.

To make the first parts of the mould, which may be the side panels, for instance, a "dam" of Plasticene

*Fig.* 1: *A cardboard frame for a model boat mould, showing how the tube and propeller tube can be moulded in*

*Fig.* 2: *After building up the glass-fibre laminated hull on the mould a final layer of linen can be applied to form a smooth surface*

*Fig.* 3: *The finished hull after removal from the mould*

should be built along the dividing line, with its perpendicular face as smooth as possible, and coinciding with the line. The mould panels can be made in plaster, but for permanence it is better to make them of Bondaglass, building up flanges against the dam of sufficient depth to allow of registering the parts accurately.

After the side panels have set the dams are removed and the edges of the flanges coated with a separating agent. The remaining panels can then be built up as before, and in order to ensure that the mould assembly is correctly located pegs or dowels may be fitted in the flanges before removing the panels from the mould.

**Advantages of sections**

The assembled mould, after coating inside with the separating agent, may be used in the same way as a one-piece mould to produce the finished structure, but for some classes of work, especially those of large size, there are advantages in making the latter in sections from the individual panels of the mould as these are easier to handle. After trimming the edges they can be fitted together and cemented by using the resin with strips of glasscloth or mat on the inside of the joint, the gaps being fllled with chopped strands of glass fibre.

It is possible to bond the structures built in this way to wood, metal or laminated plastic board, so that decks, floors, or chassis members may be incorporated in an integral structure, of great strength and rigidity. Panels may be strengthened by fitting internal ribs of the same material, and solid or tubular beadings may be built up to reinforce edges.

This property of glass-fibre fabricated structure gives it an immense advantage over practically all other structural methods which, however well designed or robustly built, nearly always have local weak points that may form a focus for eventual fatigue failure, if subject to impact or vibration.

## GENERAL HINTS ON PROCEDURE

In order to utilise the glass-fibre mat or cloth economically it is a good policy to make templates for cutting

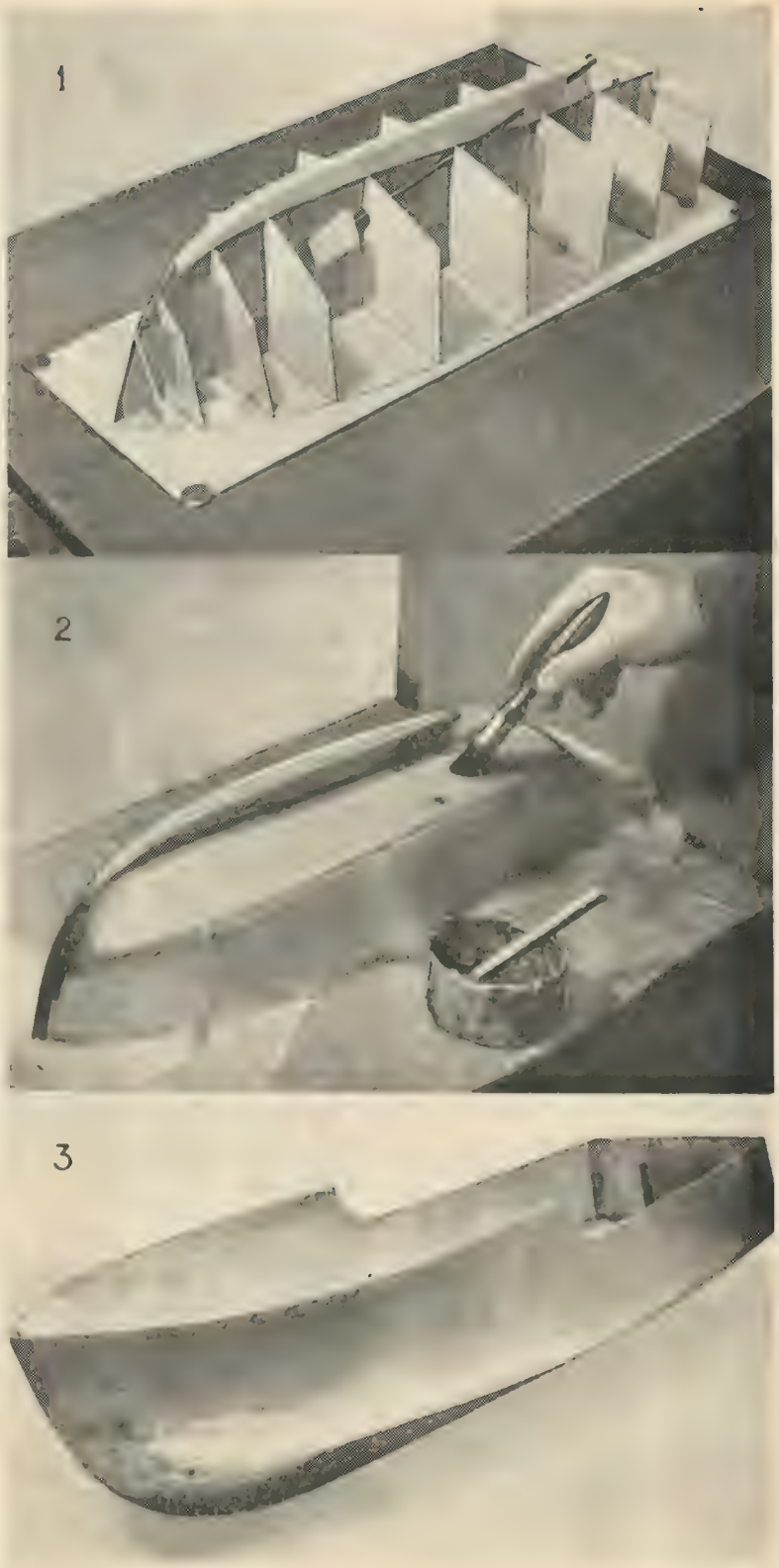
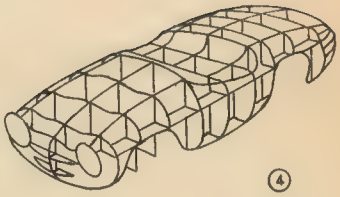


*Fig. 6: The assembled three-part female mould for a model car body*



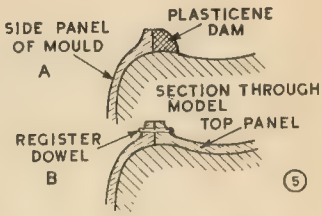



*Fig. 4: Method of building " egg-box " frame for a model car body mould*

*Fig. 5: Building up the female mould. (a) Plasticene dam to locate joint line of side panel; (b) top panel applied and register dowels fitted*

it to fit neatly into the allotted space. When working on panel moulds, the material should overlap the edges slightly, so that it can be trimmed to correct shape and size after curing.

The use of fillers in powder form, added to the resin, is an advantage in many classes of work. These substances are usually of mineral origin and they can be employed to increase the compression strength, hardness, and thermal conductivity, also to decrease the coefficient of expansion. Bondaglass filler powder can be added to the resin in proportions up to 25 per cent., and in addition to imparting the above qualities it reduces the cost of the mix.

Powdered pigments, of the kind used for mixing paint and distemper, are generally satisfactory for colouring laminates, but they should be used only in the small proportions necessary to produce the required colour. Some pigments affect the setting time of the resin, and carbon black may in some cases prevent its setting at all.

It is advisable to use accurate means of measuring the proportions of resin, catalyst, filler, etc. Exact control of these quantities is most essential as it influences not only the curing time but also the strength and other physical properties.

The brushes used for applying the mix should be thoroughly washed immediately after use in a solvent such as acetone, or a soapless detergent. If this precaution is neglected the resin in the bristles may become partially or completely cured and incapable of being re-dissolved, so that the brushes will be ruined. They should, however, be thoroughly dried before re-use. Naked lights should be avoided in the vicinity of any of the ingredients or solvents, which in most cases are highly inflammable.

To avoid getting the resin on the hands it is advisable to wear gloves or use a dependable barrier cream when carrying out the process, as the tenacious nature of the chemicals makes them much more difficult to remove than paint or varnish of the ordinary kind.

The time of curing varies with different types of resins and also with the proportions of the mix, but temperature also plays an important part and, generally speaking, it is advisable to work at somewhere near a temperature of 65 deg. F. Below 60 deg., the curing reaction is extremely slow and success dubious.

● *To be continued.*

# TWO-MILLIONTH ENGINE

Two million engines ! That is the proud production figure of one of Britain's famous lightweight engine manufacturers, Villiers.

At a recent ceremony at their Wolverhampton factory, the two-millionth engine, a 225 c.c. Mark 1H two-stroke motorcycle unit, was swung off the assembly line on to a baize-covered table where H. Geoffrey Jones, Villiers joint managing director, presented it to C. F. Caunter, assistant keeper of the National Science Museum, where it will be on permanent exhibition.

But before taking up this exalted position the engine was sent to the test house for an hour's supervision and then fitted to a Francis-Barnett Cruiser motorcycle which was driven away by T. G. Meeton, probably Britain's most experienced two-stroke enthusiast.

Subsequently the engine was displayed at the Cycle and Motor Cycle Show at Earls Court, after which it was returned to the factory to be sectioned at the request of the Museum authorities.

Villiers, who are renowned for their two-stroke motorcycle and runabout engines, also supply a considerable number of power units for agricultural and industrial application.

The first Villiers engine, completed in 1912, was a four-stroke motorcycle engine of 350 c.c. capacity, but it was to the production of two-stroke engines that the company turned so successfully at an early date in their career. ▣

# SHIP MODELLERS' HINTS

## Reader-to-reader tips to help solve odd problems

WATER INLET and outlet ducts can be made easily and economically from valve parts removed from old cycle inner tubes.

On boats up to 36 in. the bore would prove sufficient for both inlet and outlet flows. The only modification necessary would be to the inlet duct. Sufficient metal being available to open the bore for at least ¼ in., to accommodate a piece of copper tube shaped to an oval at one end to allow sufficient entry of water forced up by the propeller slipstream.

On some valves ¼ in. o.d. pipe may be fitted straight with one end sealed off and a $\frac{5}{16}$ in. × ⅛ in. slot filed out. I have used both methods with every success continually.

R. H. HOUNSLOW.

### EFFICIENT GRATING JIG

IN CONSTRUCTING built-up gratings in any scale, the finished article relies almost entirely on the accuracy of the grooves cut into the strips.

A jig for this job is a must, but how many jigs have been described from time to time which, though doing the job, seem to rely on good luck to give good results! This jig I describe here will cut accurately to within 0.005 in., with which I am well pleased considering it is of mainly wooden construction.

First you need a block of hardwood (beech is excellent) for the bed. This is 11 in. × 3 in. × 1 in. To each side of this is screwed a piece 11 in. × 2⅛ in. × ⅜ in. to make a mitre box effect. Cover the two ends with ⅜ in. thick wood, or fairly thick sheet brass or copper. Into this box fit a piece of hardwood 6 in. × 3 in. × 1 in. Make it a nice sliding fit, with no play.

In the base of this is cut a groove ½ in. deep × ½ in. wide. The two ends are covered with sheet brass or copper, with a 6 B.A. topped hole ¼ in. from the bottom drilled centrally. These holes must correspond with two more of ¼ in. dia., one in each end of the box.

The works consists of a 12 in. length of 6 B.A. tapped rod, screwed through the sliding block and locked each end of the box with nuts. A two-pin circular feeder is fitted to one end. To complete, fix a thin strip of steel squarely across the top of the jig.

I find with this jig that 7½ complete turns of the feeder equals ¼ in. movement of the sliding block. In making the gratings, the strips are laid fixed in a row on the top block. Using a razor blade make a cut half-way through the strips.

Turn the feeder a prescribed number of turns, or parts of a turn, and give another cut, and so on. The grooves are then routed with a fine chisel made from the tang of a small file. I need not describe the construction of the gratings, as this is universally known.

Although I made this jig especially for gratings, it can be used for parting off from strip any of the numerous small pieces used in a ship model.

D. A. BROGDEN.

### TIMBER FOR PLANKING

I HAVE found during the construction of a plank and frame model of a 74 gun ship that an excellent timber for planking is the African hardwood makore. In planks ¼ in. × 3/32 in. this will bend easily to curves of very sharp radius without the need for steaming, and it shows no signs of splitting.

Also, when rigging models, I find that the most useful tool for threading cordage through blocks, or reeving lanyards in deadeyes, is a fine crochet hook of No 1 or No 0 size.

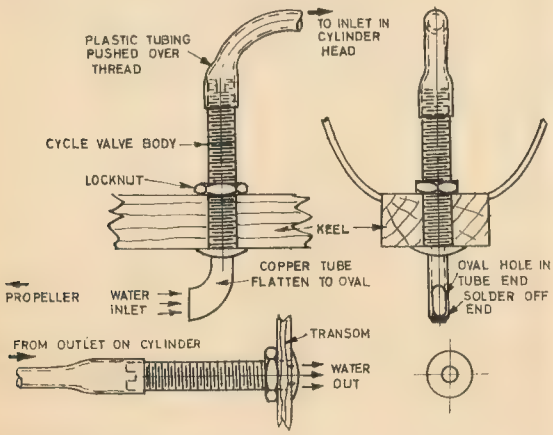
L. N. WATTS.

The special competition encouraging readers to submit hints of practical value to ship modellers, which was announced in the December and final issue of *Ships and Ship Models*, will continue in MODEL ENGINEER.

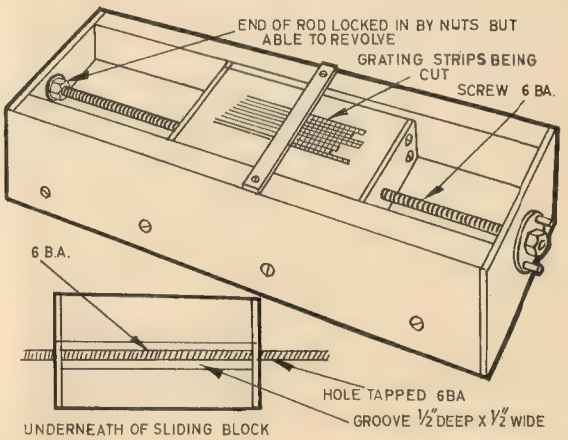
There will be a number of first-rate books as prizes, such as: *Anatomy of Nelson's Ships*, by Dr C. Nepean Longridge, price 63s.; *Sailing Trawlers* and *Drifting Trawlers*, both by Edgar J. March at 63s. each; and *The Tea Clippers*, by David D. Macgregor, price 25s. In addition Percival Marshall book vouchers value 10s. 6d. will go to the sender of each hint published.

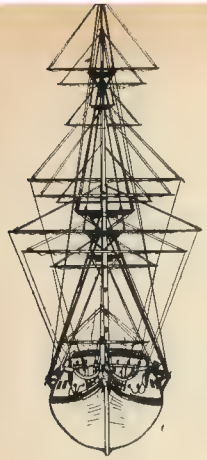
On this page is the first selected batch of readers' hints in this competition, which is open until the end of January.

*Cross-sectional views illustrating Mr Hounslow's idea for water ducts*




*The method evolved by Mr Brogden for accurately cutting gratings*


END OF ROD LOCKED IN BY NUTS BUT ABLE TO REVOLVE
GRATING STRIPS BEING CUT
SCREW 6 BA.
6 B.A.
HOLE TAPPED 6BA
GROOVE ½" DEEP X ½" WIDE
UNDERNEATH OF SLIDING BLOCK



# MYRMIDON

## *A SHIP-RIGGED SLOOP OF 22 GUNS*

**Following up his successful Early Sixth Rate venture, R. J. COLLINS has decided to go ahead with another small-ship series—this time a late 18th century man o' war**

HERE I am with another small ship—small that is in relation to the rest of the fleet as she is about 30 ft longer between perpendiculars than the heroine of the last series. Despite this, however, she is the same type of vessel, built for the same kind of job and armed with the same number of guns though these are somewhat rearranged.

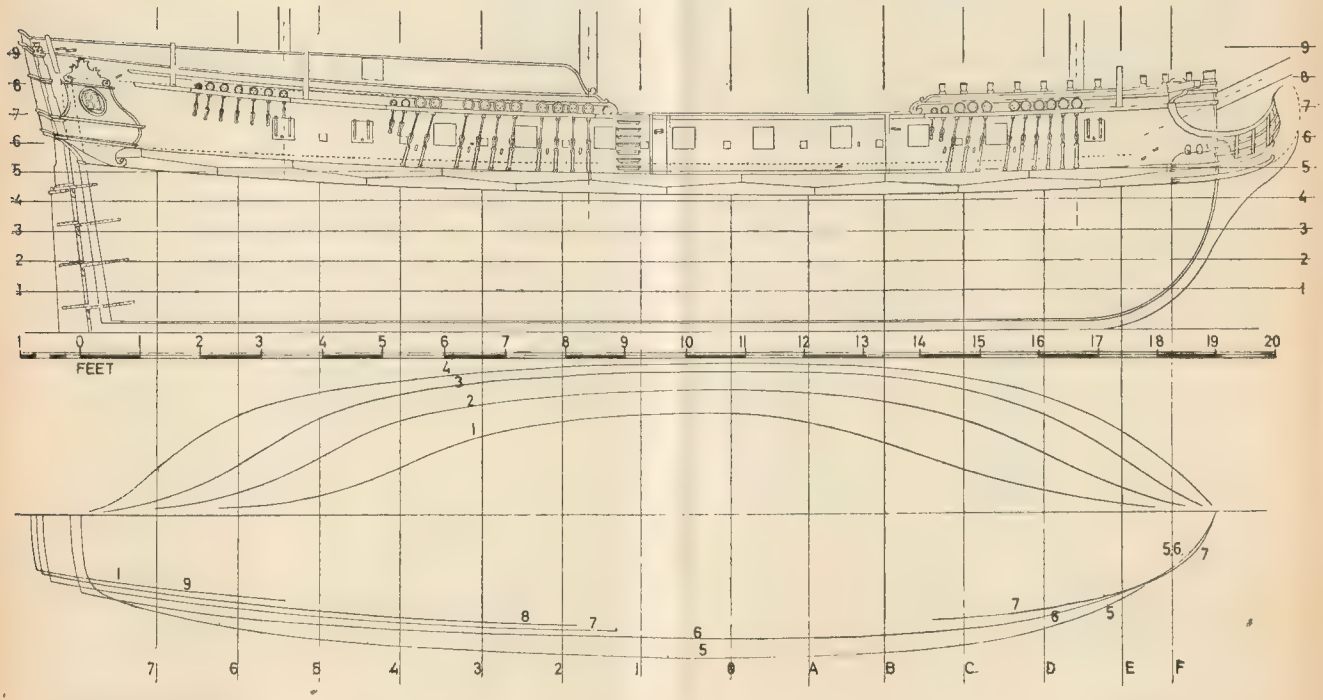
She is *Myrmidon* of 481 tons burden (built at Deptford in 1781 and broken up April 1811) with a crew of 160. Like so many of the small ships—and even some of the larger—she was copied from a French prize, *Amazon*. This accounts for the rather ample midships bend with its extreme tumblehome.

Another point about this model. It has been suggested that perhaps a tie-up with C. S. Forester's ever popular naval hero, *Horatio Hornblower*, may be of interest. Now I don't like spending a lot of valuable time on something, which, no matter how good, will always remain a fiction. So I decided to take a real ship as near as possible to *Atropos* and point out any differences between them. Actually that is easily done. Take out the last gunport and space and close up the stern. Knock off 12 per cent. from the lengths of the masts and yards, and perhaps take off a little of the beam to remove some of the tumblehome. Finally, *don't* fit the wheel.

Among the authorities consulted were the Admiralty draughts, which were obtained from the Maritime Museum, Greenwich. These dealt with the hull and the hull fittings, for by this time such draughts showed the inside as well as the outside. Unfortunately, there is no drawing of the carvings, so I have designed what little there is to be typical of the period. Sizes for the masts, spars and ropes were taken from Steele's *Elements of Mastmaking, Sailmaking and Rigging*, 1794. The style of rigging is taken from Darcy Lever's *Young Sea Officer's Sheet Anchor* 1819.

One gentleman—and one only—at the M.E. Exhibition complained to me that I made my plans *very* detailed.

*Hull lines of the model*



This brings me to one of my many hobby horses. I think that a ship's draught for a model maker should be as near perfect in all its details as the information available allows. It is up to the individual modeller to decide what he should leave out or simplify. With a correct draught he will know what it *should* be and not spend hours or days making articles which he thinks are correct, but which turn out to have been modified somewhere between him and the original.

As I have said the draught showed all the inboard works and I have included this in a later sketch—not necessarily for the model—but because I thought you would like to see what the inside of a ship of this size looked like.

The scale I work to is 6 ft = 1 in. (1/72) and except where definitely stated all sizes given are as for the real ship.

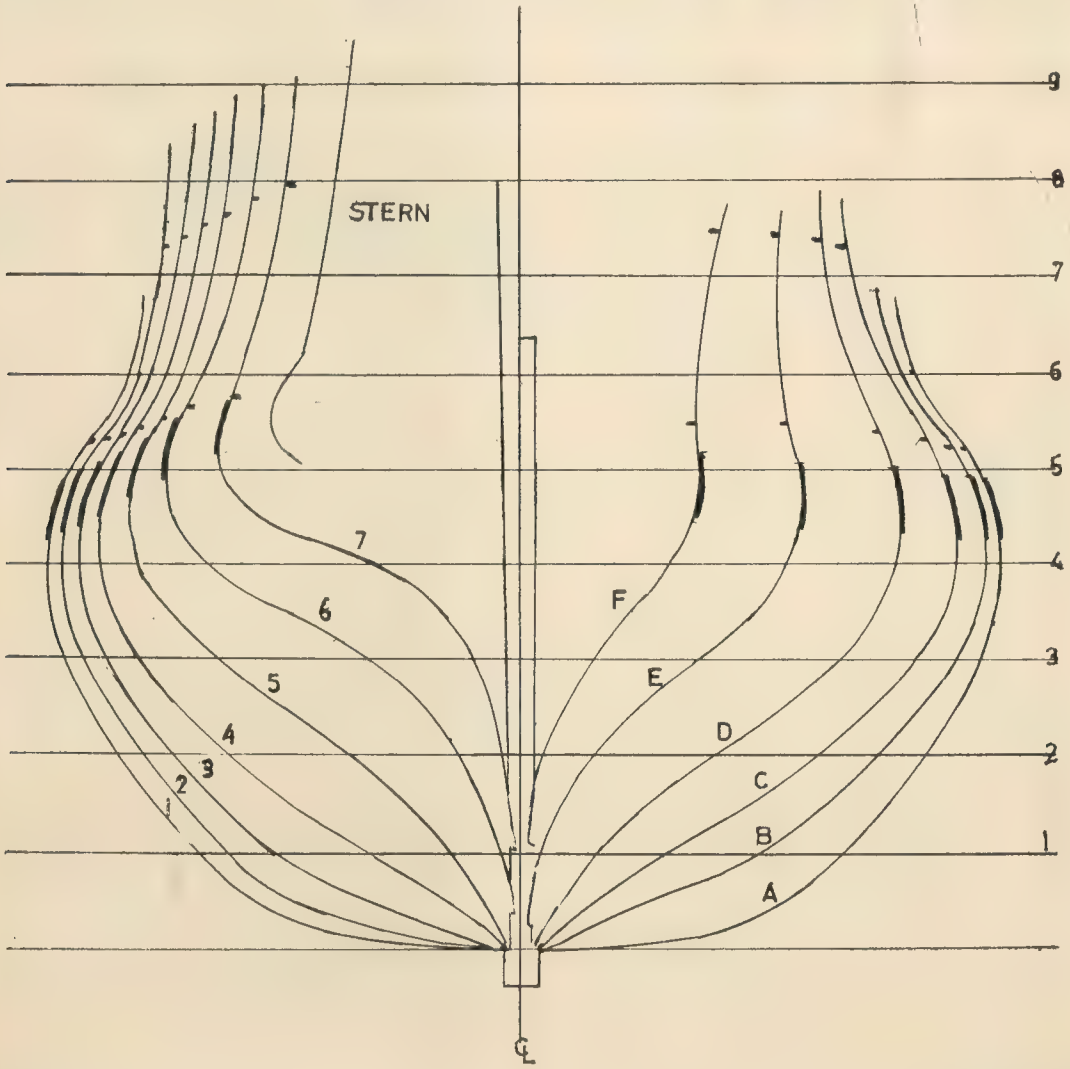
I propose to describe the building in my usual style, that is solid to the gun-deck and built up from there. As the hull should be completely painted there is perhaps a wider choice of wood—or at least the different sorts may be mixed. But keep to hard close grained kinds. The keel plate, 1 ft 3 in. thick, should reach up to the top of the upper lift. Both the stem and stern post are put in separately to take advantage of the grain. Note that the stem reaches to beneath the bowsprit and that the stern post right up to beneath the quarter deck (Fig. 1).

*Body plan* (*actual size for the model*)

Before you cut out the lifts you must make up your mind on the following matters:

From the water line down the hull is copper plated and it is for you to decide whether to plate or simply cover with a metallic paint. As a matter of interest the contemporary models do not appear to have been plated, but the standard of official ship modelling was beginning to fall off by this time.

I think the upper parts—that is from the copper to the top rail—should be planked, not only because it will look better but because the planks can be fitted to the shere and the tumblehome. Of course, the whole hull can be built "bread and butter," the top layers being taken off and the centres cut out. My own objection to this method is that it



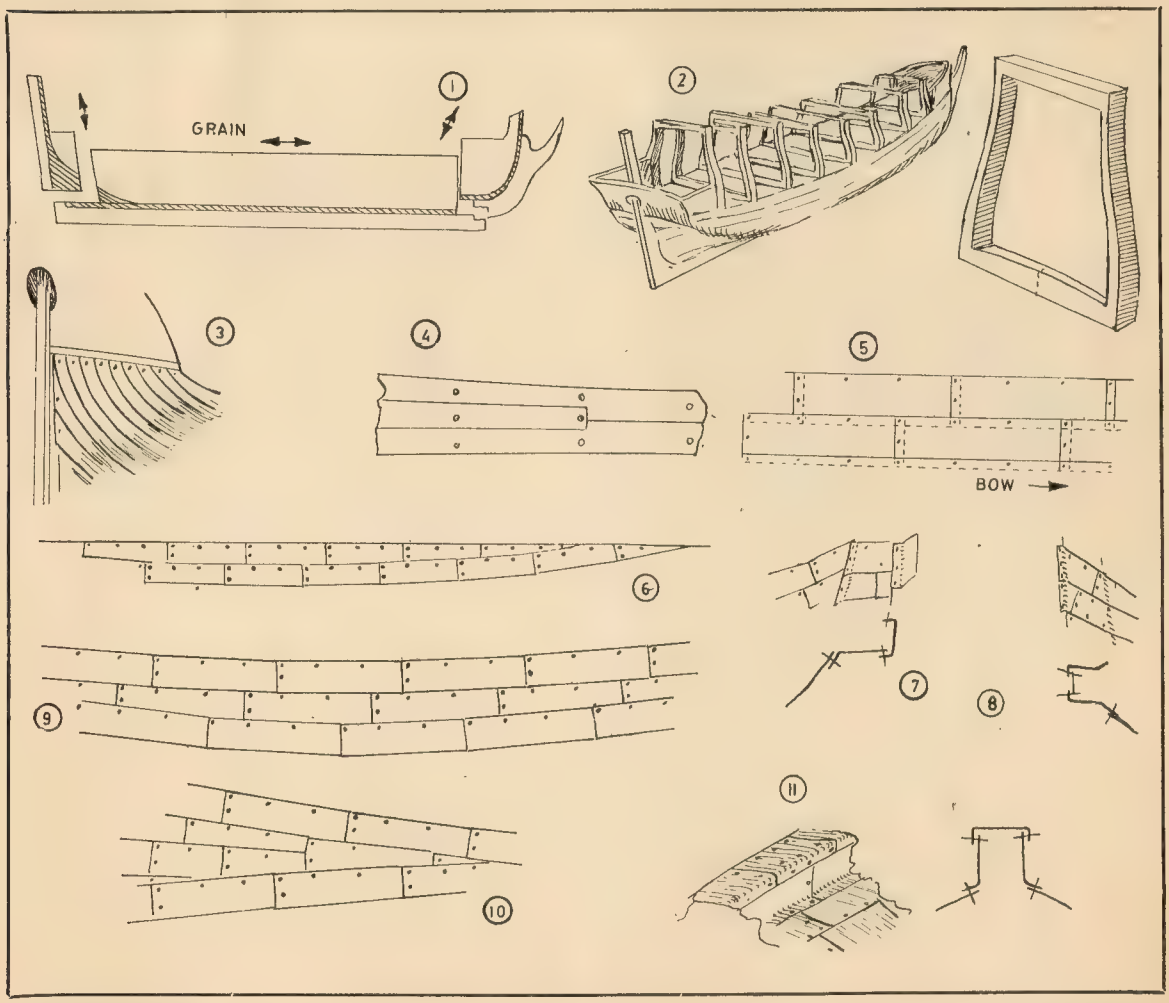
nearly always shows up, even under paint. On the other hand it doesn't matter if the planking does show a little—so long as it is hidden under the metallic paint which represents the copper sheathing.

Allowing then that the upper parts will be planked, I suggest that the bottom three lifts be cut and shaped a "plank thickness" bigger (this should be about $\frac{1}{16}$ in. actual), and the top two be correct size. The planks will then disappear under the edge of the sheathing in a normal manner. You will not have to do the awkward planking near the fore and aft part of the keel. Neither will you need the rabbet cut into the keel or on the stem and stern post as far up as the top of the third lift.

This point being decided, cut out the lifts. Don't be caught in that old trap . . . note that the top lift is larger at the *bottom* between *D* and 5. Screw them together and be careful there is no danger of the points of the screws emerging during your subsequent shaping. The lifts *can* be glued, but I should still use a few screws. When shaped, each side can be fastened to the centre pieces. I find the best way to do this is to screw the keel plates on to one side and then, with well countersunk screws, fasten the other half on to that. Fill in the countersinks with plastic wood.

Cut out the formers as I have shown in the sketch (Fig. 1). I presume these will be about $\frac{1}{4}$ in. (actual) wide. The body lines give the larger edge—aft for the forward ones and forward for those aft of the midship. Don't forget to allow for this when cutting out the insides. If you intend to use plywood, don't use it for *C* and *D*, which you will notice are higher than their companions. This is because the tops are to be shaped into timber heads. The bridge left across the tops of the others will ensure that the correct distance will be maintained while you are planking. They will, of course, be removed later.

If you cut the formers from ordinary wood instead of ply, both the bottom and top pieces will be very brittle. These can be strengthened, and I should do this by sticking on strips of card which can be left on the bottom pieces. Screw the formers on to the core and carefully trim the outsides to the curve of the hull. This can be easily tested with a long strip of planking bent around from bow to stern. You may wish to play for safety at the bow and from *F* to the stem use a shaped block of wood. Although the curve is nowhere as extreme as in earlier types I recommend this. The same applies from 7 to the stern. Both pieces must be cut to take the stem or stern post (Fig. 2).



When the outside of the formers are trimmed remove them for convenience of working and adjust the inner surface to conform. The thickness should be 6 in. at the base, tapering to 3 in. at the fo'c'sle and waist and 2 in. at the quarter deck.

**Lower wale edge**

For the plating and/or planking of the hull the model must be held bottom up and these rather delicate formers could be easily damaged. It so happens that they need not be permanently fixed until the bottom is completed. The lower edge of the wale—at this period one wide one—must be carefully marked. From here down following this shere line, the planks are 1 ft wide.

Now measure the three lengths on your model: the midship line from the bottom of the wale to the keel, the distance *straight* down from the wale to the keel at the stem and the distance along the counter and straight down at the stern. These should be approximately 23 ft for the stern and midships and 13½ ft at the stem. I say approximately because you will understand that if you have varied from the draught by a thickness of a pencil line it would alter it. This means that the planks must be harrowed to little more than a half where they meet the stem under the wale. They will also have to be narrowed a little to come easily under the counter (Fig. 3) but would be widened or have stealers inserted lower down to make up (Fig. 4). If you are only planking to the top of the third lift then these figures will suit.

Fasten the planks on with wooden pegs. Don't use metal as they might—and probably would—get in the way of the plating nails. I use the split bamboo from Chinese table mats which can be purchased in most "arty" shops. Pull them through a drawplate to get the correct thickness. They should be about two inches thick. I don't think this size is practicable in use but keep them as thin as possible. As most of the planking will be covered I don't feel too strongly about the "butting," but the rule is three clear planks perpendicularly and at least 6 ft laterally. Planks could be steamed to take the curve at the counter. A little thinning just here helps also.

**Painting reminder**

The surface below the wale, whether planked or not, must be perfectly smooth. If you are using bronze paint there must be no suggestion of planking showing through, so give it several undercoats, well flattened down, before the final. There must be a smooth surface under the plating, too, or else in course of time and handling any inequalities will show. The exposed planking should be painted black.

The size of each copper plate is 4 ft × 1 ft 3 in. and you will need a lot. I have worked out (very roughly) how many and make it a little over 1,200. If this makes you feel a little scared think how proud (and thankful) you will be when you have finished. Copper shim 0.003 in. thick is the most suitable and can be obtained quite easily.

For the nails the smallest entomological pins are frequently recommended. They have small ball-like heads and are of brass—but are extremely expensive. I personally think that the method used by Dr Longridge for his *Victory* is the best. Obtain some copper wire, as fine as is practicable, cut it into ⅜ in. (actual) lengths and then cut each piece in half with a diagonal cut, thus giving each a rough point.

Mount a small sewing needle in a pin chuck with slightly less than 3/16 in. (actual) showing. With this drill the hole through the plate and into the hull. Use a small hammer and drive in the wire nail; the tapping will burr the head sufficiently to hold the plate. (I should think that the minimum number required to hold each plate would be four top and bottom and one each end.) The strakes start at the water line and go downwards to the keel, thus the overlap is upwards. It is the other way round for merchant ships.

Make a couple of gauges with which you can mark each plate 1 ft down from the top and 3 ft 9 in. forward from the back edge. The other plates will be laid to these marks and any slight difference in size will be hidden under the covering plate (Fig. 5). This does not afford an excuse for careless cutting, but the difference of a thou or so could stick out like a sore thumb in the aligning of the plates. You will probably find it best to cut the plates in long strips of the correct width and put on the lay mark before chopping up. A razor blade cutting on glass will either cut right through or deep enough to enable them to be broken off. Don't use scissors as this will leave a burred edge. The other lay mark could be put on after the plate is fixed, using a pair of dividers. But once having set the dividers keep them set until the job is completed.

As the sheathing strakes don't narrow the runs have to be broken at the bow and stern. Put the first plate on about amidships with its top level with waterline No 4. Fasten this one with only the top two centre nails. Place the next plate forward with its overlap up to the mark on plate No 1. The end nail and the fourth top nail will go through both plates, then the top second and third; the top first will be the top fourth of the next plate.

The bottom of the plates will be nailed by the top nails of the next strake (Fig. 6). The bottom of these plates should be above the top of the third plank and by the end of the third or fourth plate should actually meet it. Let the plates then follow this upwards but trim their tops so that they keep level with the water line. They should peter out somewhere forward beneath gunport No 1. Now work aft, inserting each plate under the preceding until they, too, meet the top of the third plank. Follow this up and finish somewhere beneath gunport No 10.

**Align carefully**

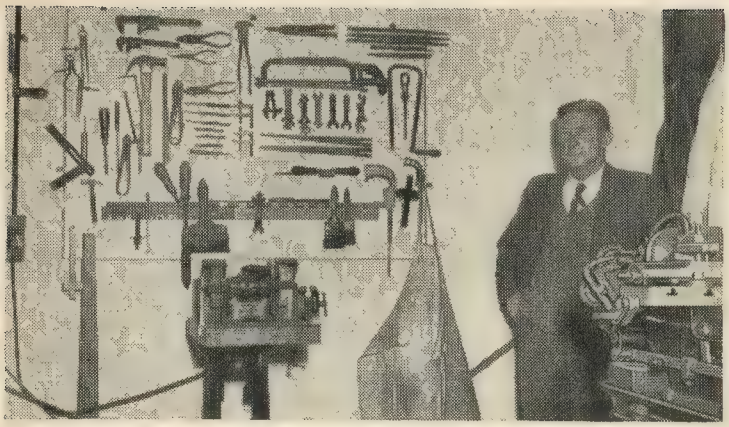
Start the next strake 1 ft 4 in. aft of the back end of the last completed length, align it carefully with the mark and nail down. As this strake progresses forward it will be noticed that towards its ends it does not now follow the plank shere and that its tapering off is much quicker than the first.

When the plates reach the stem they are cut off flush into the corner. The plates which overlap these are worked parallel with the waterline on the flat of the bow. They, therefore, do not coincide with those on the hull. The one on the actual cutwater is trimmed to overlap both sides (Fig. 7). At the stern let the plates take in the stern post. Fig. 8 will show the difference to the bow.

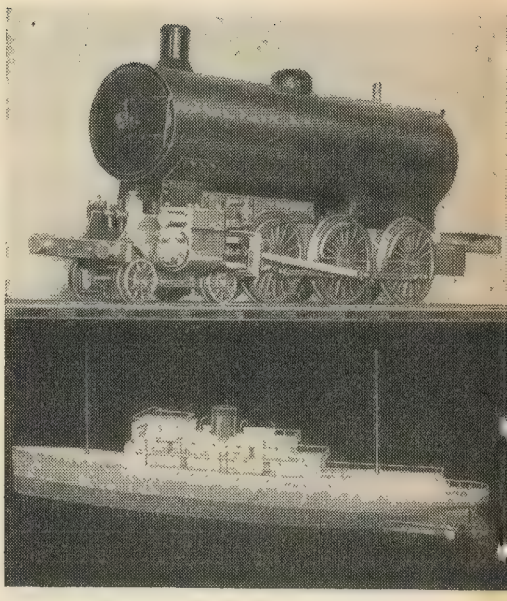
Carry on down both sides until the ninth strake is completed. You will now notice that it is becoming difficult to run the strake along smoothly without overlapping the end of each plate diagonally. If you take a long strip of sheathing before you cut it into separate plates and lay this smoothly on the hull with its centre in the correct position you will see that the ends run well into the sheathing already attached. This line will be the shere of the rest of the plating (Fig. 9). Work in a wedge of stealers to bring the strakes level with the keel (Fig. 10). I should do this about half way down.

Cover the keel as you did the flat of the bow. Then trim the hull plates to fit to the keel, the side keel plates to overlap those on the hull and the bottom keel plates to overlap those on the side (Fig. 11). I have tried to put this as clearly as possible, but I also made some sketches to explain further. But please remember that these drawings are diagrammatic and are not correct as to the number of plates or the degrees of curvature.

● *To be continued.*



*A place for everything and everything in its place ! The author in his well-equipped workshop*



*The loco partly completed and beneath it the also incompleted ship*

# Construction of a locomotive

**With the help of M.E. anyone can succeed if he really tries, says T. E. LOWRY**

I HAVE BEEN a subscriber to MODEL ENGINEER since 1926 and I cannot tell you the pleasure I have derived from its pages. In the first copy I received L.B.S.C. was describing the building of *Sir Morris*, and from that day on my ambition has been to build a locomotive.

Not having the equipment at the time, I tried my hand at ships and the one in the picture, still incomplete, is the result. I must say that it is anything but a success, since my interest was never very serious. However, it did give me something to do.

It was not until 1951, when I obtained a second-hand Drummond 3½ in. centre lathe, that I felt I could tackle the locomotive. The photographs show my workshop and models.

The locomotive is a freelance affair and the only castings used are the wheels; all the rest came from the scrap heap. It is built to 1¾ in. gauge.

The cylinders are $\frac{9}{16}$ in. bore and $\frac{7}{8}$ in. stroke, and were made from a brass bolt about 2 in. dia. and 5 in. long. I had had no experience of turning but after studying the articles in MODEL ENGINEER I was delighted with the result.

How to cut the ports was my biggest worry. However, I obtained from a dentist friend all the discarded dental drills he could give me and by careful manipulation and about a week's work I eventually got them done. I can't say how many drills I broke in the process, but the job was done.

The wheels did not give much trouble. The axles were made from discarded motor-car valves. The pistons, piston rods, cross-heads, valves, rocking arms, etc., were all made from bits and pieces.

The connecting rods and coupling rods were cut from the frame of an old rusty perambulator, but I felt I could not tackle jointed coupling rods, so I made them straight. She is fitted with sprung axle boxes, which seem to work in spite of the straight coupling rods.

Having got the chassis assembled I wondered if the thing would work, so after setting the valves I put the motor-car pump on to the steam inlet and you can imagine my delight when the wheels turned. I was so excited that I packed the whole lot into the car and went off to pick up my old friend Mr Straton, and we set off for the nearest garage and some free air.

I don't know what pressure a free air system holds, but I can assure you that the two of us were like a couple of schoolboys on a half holiday spree. When it was over, I couldn't believe that I had done it.

The boiler is of the water-tube type, having three ¼ in. tubes, and it is 10 in. long and 2 in. dia. The outer casing is cut from 22-gauge copper and brazed on to the smokebox ring, the other end being fastened to the backhead with 9 B.A. screws.

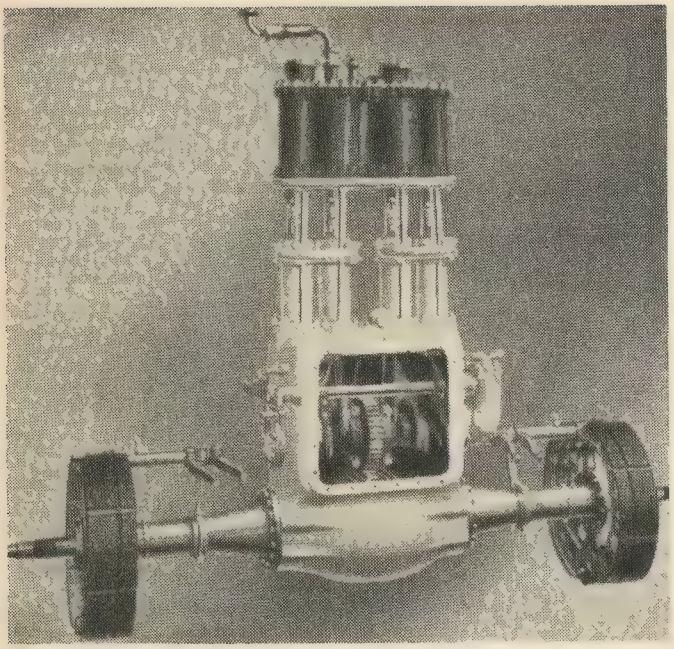
The backhead is cut from ⅛ in. brass, and I got a friend with an acetylene outfit to braze it to the boiler tube, and also to braze in the tubes. The only backhead fittings are the regulator, which is of the push-pull type as described for *Little Jack Horner* many years ago, and the blower valve from the same source.

The burner I made from three Martini Henry cartridge cases brazed on to a $\frac{5}{16}$ in. tube. There is a sump at the end which projects under the tender and is kept full by a drip feed from the tender. The valve for this came from an old Gloria Light.

My next job was to put up an oval track in the garden which, though very rough, enables me to give the locomotive a continuous run of about 75 ft circumference. The longest run the locomotive has made is six complete circuits. This, I know, is not a great achievement but as a first attempt I am satisfied.

She is by no means a masterpiece, and I know she is full of faults, but if there is any reader who thinks he cannot build a locomotive that will work my advice to him is " have a go."

In conclusion, I would like to pay tribute to the contributors of MODEL ENGINEER who enable us to take ourselves away from the daily grind and really enjoy the workshops we own. ▣



# The design of a STEAM CAR

By George W. McArd

**A review of steam-car power units and transmissions together with some suggestions for more modern vehicles**

*Fig.* 1: *Doble four-cylinder engine and back axle assembly*

PERHAPS the finest recommendation for all steam-driven cars is the marvellous enthusiasm of those who know them best. The writer is fortunate in that his own experience goes back to the early days of motoring when many i.c. machines were driven by single-cylinder engines with heavy flywheels in which the required energy was stored for rotation between the power strokes of the motor.

Even with present-day multi-cylinder engines it is still essential to maintain a relatively high revving speed for the i.c. engine in order to develop the necessary torque for traction; the steam engine, however, generates its maximum torque precisely when most needed, i.e., when starting from rest.

A clutch is unnecessary, and it is an astonishing fact that although 60 years have passed since the petrol engine became a regular feature in automobile design, the qualities so obvious in even the earliest steam cars, viz.: smooth and effortless operation with complete silence on the road (apart from tyre noises) are recognised by all opponents as the ideal to be aimed for.

The two outstanding units in any steam car are (1) the engine and transmission, and (2) the steam generator; each will be discussed in the order stated, since the type and proportions of the first will influence the steam demand on the latter.

In an article of this character, space does not allow for a discussion of the theoretical side so I will seek rather to present a few of the various designs of power unit and generator, any of which will give good service, with supplementary notes regarding auxiliaries and the general layouts which may be adopted. From a survey of these the prospective builder may make his choice and must then develop and proportion the various items to suit the power output as anticipated.

I might mention here for the benefit of those to whom the matter of design might be a stumbling block that a very live organisation—the British Light Steam Power Society—exists, with members vitally interested in this subject, and they are ready to co-operate with all who have the desire and practical ability to proceed in the design of a steam car.

The first decision to be made concerns the type of engine to be used, and this problem is best considered along with the form of transmission visualised. Will the engine be simple or compound, and the cylinders designed for single- or double-acting?

Stanley and Doble both used the double-acting type, which provides more power in a limited compass. But where Stanley preferred a simple engine, Doble ultimately chose the compound, after early experiments with the two-cylinder simple engine. His four-cylinder compound is shown in Fig. 1, this illustrating the method of transmission also.

Serpollet, a famous French pioneer, preferred the single-acting engine, and provided two types, each using four cylinders, viz. a flat-4 (Fig. 2) and a V-4 (Fig. 3). Another design of single-acting engine is the Planet, in which four cylinders placed diagonally as seen in Fig. 4 will afford an excellent means of combining simplicity of design and high torque with accessibility and a straight-through drive to the rear axle.

The Planet design, indeed, yields a useful power unit for the man with limited time at his disposal who wants a steam car with a minimum of delay, i.e., by stripping the i.c. engine and its accessories from a suitable chassis and re-building the vehicle with new steam components.

Minor features, though by no means unimportant, concern the detail design of the engine and the valve gear to be fitted. My own experience centred round the design and construction of a car having a two-cylinder double-acting engine using Stephenson's double-eccentric reversing valve gear, somewhat similar to the Stanley engine. As all parts were generously proportioned, a long life was assured. The general lines of this unit are indicated in Fig. 5.

Doble had a special design of single eccentric which was capable of axial movement for notching up purposes to improve steam consumption economy, also for reversal. Serpollet, Planet and many other knowledgeable designers prefer poppet valves operated by cams, and a

## Design of a steam car . . .

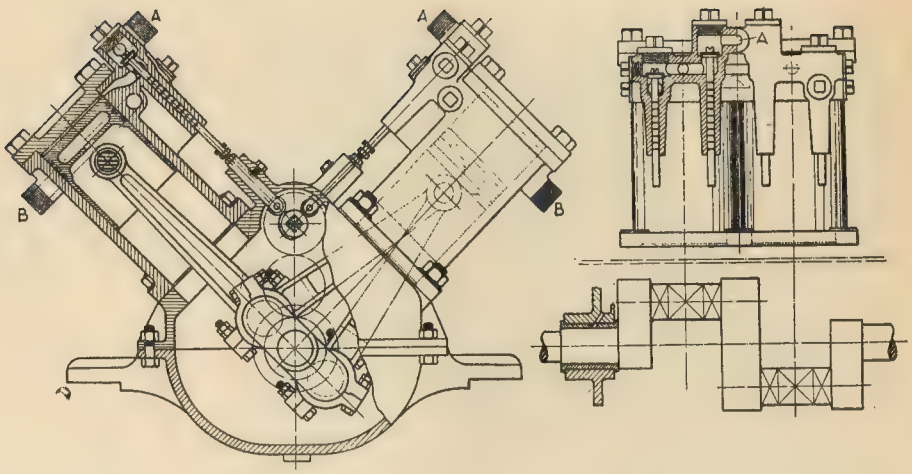



*Fig.* 3: *Serpollet's V-4 engine*

careful study of the pros and cons regarding valves and valve gear should be made at this stage; if eccentrically-operated control is preferred, a decision must be made between some form of slide or piston valve. The poppet valve has many adherents, but the piston valve, which is of necessity small in diameter for an engine of this class, has relatively few; among the latter, however, its use seems to be preferred very definitely for a compound engine.

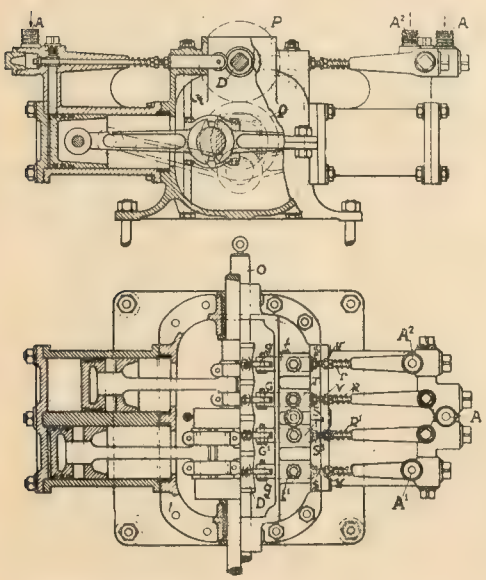
The method adopted for transmitting the engine torque to the driving wheels varies appreciably and affords a prospective builder a wide choice. In the Stanley and Doble cars the engine and back axle are combined as a single unit, the drive passing from the engine crankshaft to the axle differential through a pair of gears. In the steamer I helped to build the engine crankshaft was located about 3 ft ahead of, and parallel with, the rear axle, a sprocket being fitted for driving the differential through a stout chain.

A third alternative, adopted with the Planet engine, drives the rear axle through a Hardy Spicer cardan shaft, after the multi-speed gearbox, used by the maker of the original i.c. engined car, had been removed. The fitting of a gearbox and clutch to a steamer is quite optional and normally not necessary; it depends on other factors associated with the general design of the car.

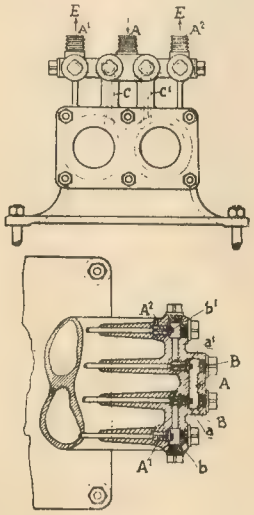
If, for example, engine proportions are relatively small—deliberately so, perhaps, to suit its maker's workshop and lathe facilities—it may be an advantage to use, say, a two- or three-speed gearbox and by this means increase the torque delivered to the axle. For similar reasons the designer may also prefer to include his reversing mechanism in the gearbox and eliminate all reversing complications from the engine.

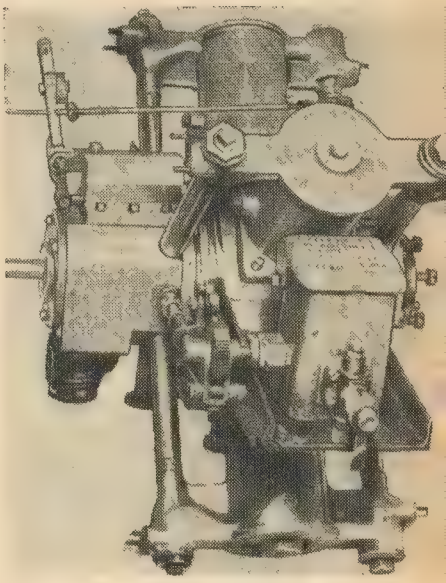
Many engineers prefer to fit a clutch, not for operation on the road but to permit running the engine with

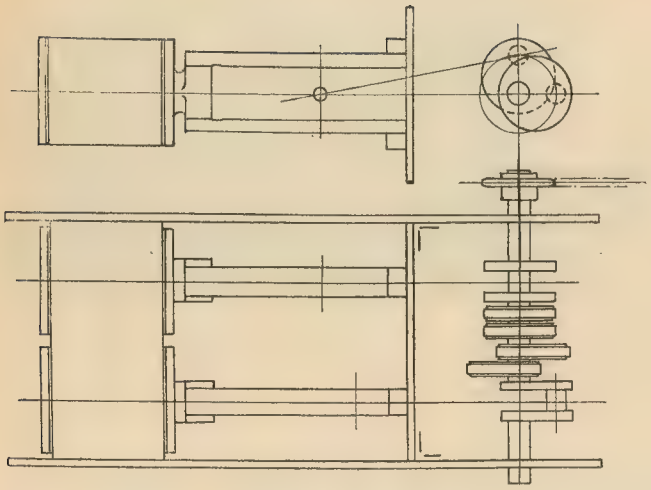
*Below, Fig.* 2: *Serpollet's flat-four engine*



*Right, Fig.* 4: *Planet four-cylinder, single-acting radial engine*







the car stationary for testing the water and fuel pumps, etc., and thus remove any doubt of correct functioning which may have arisen during the last trip.

Steam may be generated in several ways. Stanley used a firetube boiler somewhat similar to that shown in Fig. 6, with suitable provision to safeguard the water level from falling below a predetermined point. Doble, on the other hand, after using a special design of watertube boiler on his earlier cars swung over to the vertical flash type generator shown in Fig. 7.

At the left is seen the blower motor for the forced draught, air being delivered through the venturi tube where it mixes with the atomised fuel. The mixture is ignited by the flash at the sparking plug, and the flame passes downwards into the combustion chamber and thence through the tube coils, the fumes exhausting finally through the lower flue to the left.

Another generator in service is the well-known Derr type water-tube boiler using a selected number of grids according to the generating capacity called for. A typical unit is that provided on the Claydon steam car recently illustrated in some of the technical papers.

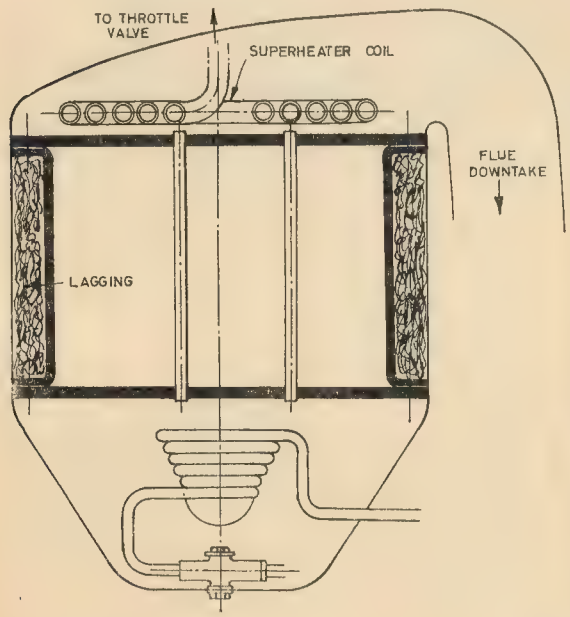
In this unit a row or grid of 10 vertical tubes ($\frac{3}{4}$ in. bore) is provided, having top and bottom tubular headers ($1\frac{1}{2}$ in. bore) into which the upper and lower extremities are welded. A bank of 10 horizontal, or slightly inclined, tubes ($\frac{1}{2}$ in. bore) runs from a rear header into each of the main verticals, the complete unit providing approximately 25 sq. ft of heating surface.

In every type of generator, provision must be made for a superheater unit of ample proportions for the temperature required, the most desirable pressure and temperature respectively being agreed by many qualified steam-car builders and users, including the Doble brothers, to be in the region of 750 p.s.i. and 750/800 deg. F.

The choice of a suitable burner is another important matter, and in place of the vaporising burner used almost invariably in early steam cars, preference today goes to the pressure-fed atomising unit with spark ignition on the lines shown in Fig. 7.

Having decided on the design of such major items as engine and generator, the scheme must now be developed as it relates to the water and fuel feeds for generator and burner.

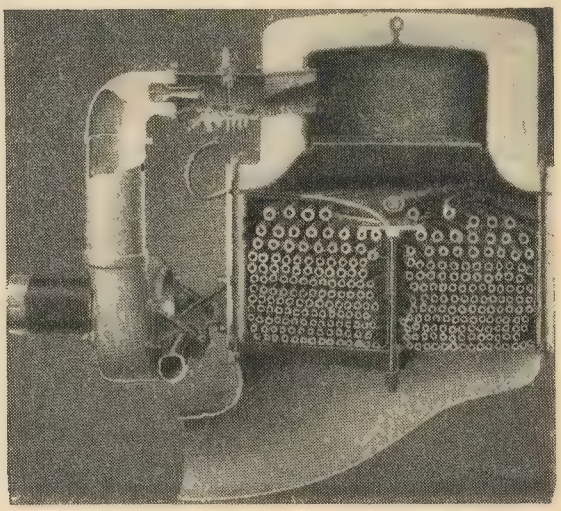
In some of the earlier machines these controls were left to the individual judgement of the driver, but experience indicated that the wiser plan was to provide some form of automatic control such as the Doble, White and Stanley cars possessed. The first-named had a good scheme in which practically all pumps (oil, water and vacuum) were assembled and carried on the chassis as a distinct unit.

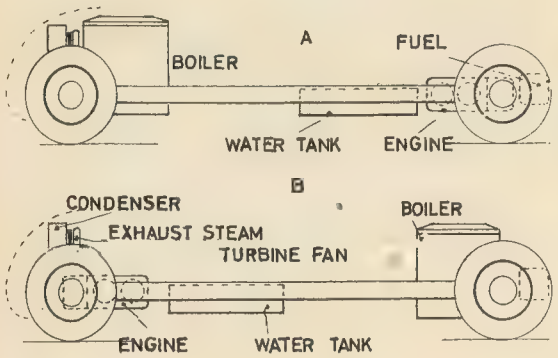


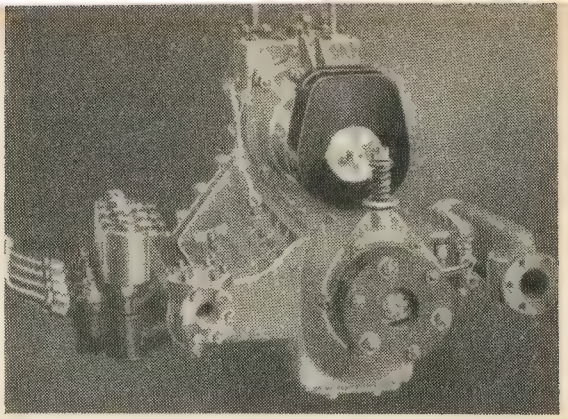

*Top, Fig. 5: Locomotive-style engine; two-cylinder, double-acting and reversible*

*Left, Fig. 6: Firetube boiler with vaporising unit*

*Below, Fig. 7: The Doble monotube steam generator*





*Above, Fig.* 8: *Doble auxiliary unit*

*Left, Fig.* 9: *Alternative layouts*

One of these is shown in Fig. 8. Careful thought should be given to the method to be adopted for the water and fuel feeds, water level and pressure controls, also remaining essentials such as the lubrication of engine cylinders and other leading points. On settling the lines to be followed a schematic diagram for the whole system should be made, from which the actual piping can easily be produced at a later stage.

One feature relative to the feed water concerns the desirability, or otherwise, of fitting a condenser. If none is required the engine exhaust will pass to the atmosphere in much the same fashion as do the exhaust gases from an i.c. engine. The inclusion of a condenser, however, suggests the further desirability of a filtering device through which the exhaust steam will pass, depositing whatever oil may be held in suspension on the renewable filtering medium.

My personal opinion is that the extra refinement of condensing equipment can scarcely be justified except when the car is to operate in areas where water is of very poor quality or difficult to obtain.

The lubrication of the car and its engine should be simplified as far as is consistent with dependability, and the target to aim for should include as few varieties of oil and grease as can be planned. The absence of a multi-speed gearbox affords a useful elimination, and so far as greasing points are concerned the latest automobile practice must be followed.

Tanks for water and oil fuel will preferably be of aluminium, with capacities in keeping with the anticipated demands from generator and burner, and the purposes for which the car will be used. The inclusion of a condenser will permit a smaller capacity for the reserve feed water tank, but it may be useful to consider including a small length of hose in the toolkit through which additional water supplies may be taken on in emergency.

Electrical equipment will be required for lighting purposes, also for the air blower, sparking plug and motor pumps (fuel and feed) where these are included in the scheme. One or two points for the usual portable handlamp will be a wise precaution, also provision for trickle feed to the battery.

**Use of aluminium**

The design of the underframe should be given careful thought if the engine power is not to be used in a wasteful fashion hauling unnecessary material over the roads during the lifetime of the car. In modern times an aluminium structure can be evolved which will afford equal, or even greater, strength than a steel underframe but which will have a lower total weight. The cost might be slightly higher, though this is problematic since aluminium is approximately one-third the weight of steel. A very definite advantage would be the longer life afforded through immunity from rust and corrosion.

For similar reasons the body will be designed to combine the greatest comfort and protection from weather with the least increase to the total weight of the car. To achieve this many designers have introduced aluminium in various forms with much success, but front-line craftsmen are today turning to reinforced plastics—a combination of polyester resin and glass-fibre laminates—with advantages which include a minimum of cost in production tools and moulds, the possibility of using semi-skilled labour, freedom from corrosion and from the necessity of repeated enamelling to maintain an attractive appearance.

With the principal units settled, so far as design is concerned, the positioning of these in the chassis calls for a measure of skill to ensure (a) the best relative location for the leading units, and (b) a correct weight distribution over front and rear axles. Several layouts may be adopted; one of these, *A* in Fig. 9, has the engine and rear axle as a unit assembly, the condenser (if any) and generator in front of the dashboard, the water tank between the frame side members, and the fuel tank in the usual place behind the rear axle.

In the alternative scheme, *B*, the boiler is placed below the rear seats, and the engine, an independent unit, is beneath the bonnet and drives the front axle. This scheme has excellent features, not least of these being the position of the fume outlet at the rear of the machine, plus the reduction in the weight of unsprung masses.

The steam-car designer of today has at his disposal a mass of experience in regard to general automobile practice, together with metallurgical knowledge unknown to the pioneers. Even in the realm of insurance most leading companies would be favourably inclined to the steamer and prepared to consider its insurance at standard rates provided no abnormal features were introduced.

I would like to make acknowledgments to the editor of *Light Steam Power* for his courtesy in providing illustrations for Figs. 1 to 4, and 7 to 9. ▣

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**BELT DRIVES**

*Belt Drives in the Small Workshop* by Duplex is a small useful book dealing with light transmission belts in all forms suitable for small power. It costs 3s. 6d. plus 3d. postage if ordered from the publishers, Percival Marshall and Co. Ltd, 19-20, Noel Street, London, W.1 (U.S.A. and Canada $1.00).

**L.B.S.C. describes a grate and ashpan for both sizes of boiler and continues with details of the boiler fittings for those who are making this old-time loco**

# VIRGINIA

*Continued from 27 December 1956, pages 914 to 916*

SOME of the full-size engines of *Virginia's* day were furnished with rocking grates and I had in mind to specify a simplified version for the little locomotive as I have not as yet described such an accessory.

However, when I came to go closely into matters, it was obvious that the tiny fingers (which unlike those in the well-known song would certainly never be frozen !) and the operating gear would soon be choked solid with ashes and grit and rendered useless. I therefore substituted a simple box-type ashpan with the grate attached to it, the whole lot being arranged to dump by just pulling out a single pin.

There is no need to lift the engine off the rails, either for dumping or replacement. When the pin is pulled out, the grate and ashpan, plus residue, drops between the rails—a regular ashpit could easily be provided on any line—and if the engine is then wheeled along out of the way the ash and grit can be removed. The whole bag of tricks can be replaced in a minute or so by bringing the engine back, lifting the assembly into place, and putting in the pin.

The grate may either be cast or built up; I prefer a casting. If the feet or supports are cast on, no machining at all will be necessary, the attachment to the ashpan being the same as a built-up grate. If the feet are not cast on, bend up similar feet to those described later and fit them in the first space between the bars at each side of the grate, securing by $\frac{1}{8}$ in. screws put through clearing holes in the bars into tapped holes in the supports.

A built-up grate will need six pieces of $\frac{1}{8}$ in. × $\frac{5}{16}$ in. mild-steel strip, the ordinary "black" grade being quite suitable. Cut to $3\frac{3}{4}$ in. length for the larger boiler and add an extra $\frac{1}{16}$ in. for the smaller one. Mark one out and drill as shown, and use as a jig to drill the rest. The bearers are $1\frac{5}{8}$ in. lengths of $\frac{1}{8}$ in. round steel, rustless for preference, with a few $\frac{1}{8}$ in. or 5/36 threads on each end.

The six round spacers which are located between the inner bars are $\frac{1}{8}$ in. slices parted off from a piece o $\frac{1}{4}$ in. steel rod held in the three-jaw and drilled with No 30 drill. The easiest way to make the feet is to bend over the end of a piece of $\frac{1}{8}$ in. × $\frac{1}{4}$ in. black mild steel in the bench vice, to dimension shown, then cut the strip at $1\frac{1}{4}$ in. above the bend. Round off the end with a file and drill it No 30. The actual feet are drilled No 40 and tapped $\frac{1}{8}$ in. or 5/36 for fixing screws.

To assemble, put a nut on one end of each bearer, poke the bearer through hole in bar, put on a support with the foot outwards, then another bar, then a round spacer, repeating bars and spacers until five are on, then another support with the foot in the opposite direction, then the final bar, and the nut.

Arrange supports and spacers at the opposite end in same order, tighten nuts well up and burr over the ends of the bearers so that nothing can come loose when the engine is at work. Tip—use thin nuts (locknuts) so that the grate will fit easily between the sides of the firebox.

## ASHPAN

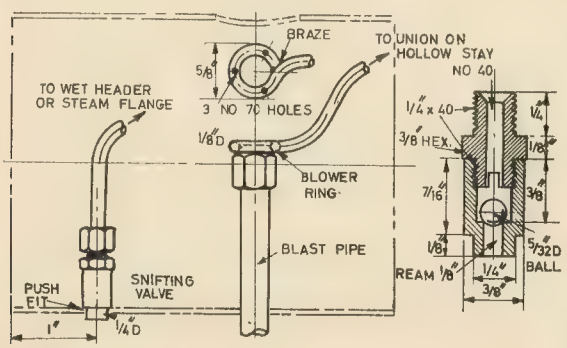
To make the ashpan, cut a piece of 18-gauge sheet steel 4 in. × $4\frac{5}{16}$ in. Bend over at right angles at 1 in. from each longer side so as to form a channel with rounded bends. This should just fit nicely over the bottom of the firebox. Cut a piece of the same material to fit in one end and braze it in; stand the channel end-up on a piece of asbestos millboard on the coke in the brazing pan, with the end piece in place.

Put a fillet of wet flux around the joint on the inside, heat to bright red and apply a bit of soft brass wire all around the joint. This will melt and flow into a nice fillet if the heat is right. Quench in water only. I never could understand why many folk fight shy of brazing; I always found it easier, if anything, than soft-soldering.

When a child of 10, with the aid of a mate of contemporary years, mother's bellows, some coke, borax, brass wire, and an extemporised "forge" consisting of a drain cover propped up on three bricks, I successfully brazed up the broken axle of a child's mail-cart. The owner's father wouldn't believe that we had done the job until my mother confirmed it.

Stand the grate in the ashpan and temporarily clip it in place with a couple of small cramps over the feet at the open end of the ashpan. Put the ashpan up in place and adjust the grate if necessary to fit in the firebox. Remove it, mark the position of screwholes in the feet, on the ashpan, with a bent scriber inserted in the holes, drilling No 30 holes at the marked places. The grate can then be permanently fixed to the ashpan by four $\frac{1}{8}$ in. or 5/36 screws with any kind of head that you fancy.

Cut two brackets from 16-gauge steel to the size and shape shown in the section and rivet them to the projecting part of the firebox with two




*The arrangement of the blower and the snifting valve*

3/32 in. iron rivets in each. These should be countersunk both sides. In the middle of each side of the ashpan and ½ in. from the bottom drill a No 30 hole. Put the ashpan in place, holding it tightly against the bottom of the firebox, put the drill in the hole in the side and drill through the bracket, repeating the process on the other side.

Cut a 2½ in. length of ⅛ in. round steel, round off one end a little and fit a nut to the other end, or a knob if preferred. This, when pushed through holes in ashpan and brackets, holds the lot securely, and permits of instant detachment; see cross-section.

## SNIFTING-VALVE

Although snifting-valves, or vacuum relief valves as they are officially termed, have gone out of fashion in full size, being replaced by anti-carbonising valves which destroy the vacuum by admitting a little steam, plus a small quantity of oil, they are still advisable on small locomotives.

They not only destroy the vacuum and prevent grit and ash getting into the cylinders, but they allow the engine to coast freely. *Virginia* has one concealed in the smokebox.

To make it, chuck a piece of ⅜ in. round rod in the three-jaw, face the end, turn down ⅛ in. length to ¼ in. dia. and part off at $\frac{7}{16}$ in. from the shoulder. Reverse in chuck, centre, drill right through with a No 34 drill, open out and bottom to ⅜ in. depth with a 7/32 in. drill and D-bit. Tap the end ¼ in. × 40 and put a ⅛ in. parallel reamer through the remnant of 34 hole.

Chuck a piece of ⅜ in. hexagon rod, face, centre deeply, and drill to ⅜ in. depth with No 40 drill. Turn down ¼ in. of the outside to ¼ in. dia. and screw ¼ in. × 40. Part off at $\frac{5}{16}$ in. from the shoulder. Reverse in chuck, turn down $\frac{3}{16}$ in. length to ¼ in. dia. and screw ¼ in. × 40, cross-nicking the end with a flat file.

Seat a 5/32 in. rustless ball on the reamed hole and assemble as shown. Fit a ¼ in. × 40 union nut and cone on the end of the pipe from the wet header on the smaller boiler, or on both ends of a piece of 5/32 in. pipe of similar length, for the larger boiler, attaching one end to the union on the steam flange. The other end of either pipe is attached to the snifting-valve.

Drill a ¼ in. hole in the bottom of the smokebox 1 in. from the front end. When the boiler is erected on the frames the spigot at the bottom of the snifting-valve is pressed into this hole so that it can suck clean air from outside the smokebox when the engine is coasting.

## BLOWER RING

Soften one end of a piece of ⅛ in. × 22-gauge copper tube and bend it into a ring ⅝ in. outside diameter, so that it will sit easily on the blastpipe nozzle. Braze or silver solder the joint where the end of the pipe butts against the beginning of the ring then drill three holes with No 70 drill equidistant around the ring. Cut off the tube at 3 in. from the ring and fit a ¼ in. × 40 union nut and cone to it.

I might mention here that I have been asked by several beginners what is the exact shape of the cone and how is it attached. For their enlightenment, the cone does away with the necessity for a separate union lining, as it is known in the plumbing and allied trades. The lining is a short bush or socket, one end of which is coned, or turned taper, to fit the countersink-like depression in the union screw. The parallel part fits the hole in the union nut, and the bush is drilled to take the pipe.

### Permits smaller size

My arrangement only needs the cone and so enables a much smaller union nut and screw to be used for a given size of pipe. The nut is drilled to fit the pipe. A piece of rod, copper for preference, is turned to fit easily in the nut and centred and drilled to suit the pipe. The end is then turned to approximately the same taper as a centre-drill, which can be done by setting the topslide over to an angle of 30 deg.

If the rest has no graduated collar put a centre-drill in the chuck and set the rest parallel with the tapered part of it. After turning, part off the cone from 1/32 in. to $\frac{1}{16}$ in. beyond the taper, according to the size of the cone. Put the nut on the pipe, hole end first, then put the cone on the end of the pipe and silver solder it, being exceedingly frugal with the silver solder. If any gets on the turned cone, you've had it—the union will never be tight.

Please don't treat my remark about putting the nut on as frivolous; readers would be surprised at the number of good folk who have carefully silver soldered the cones and then found that the nut was missing ! There is no need to attach the blower pipe to the thoroughfare nipple on the hollow stay until the boiler is erected.

## THE CHECK VALVES

Three check valves, or clackboxes as they are known in the U.K., will be required; two for attachment to the boiler barrel for pump and injector feeds, and one at the side of the wrapper for the feed from the emergency hand pump in the tender.

Chuck a piece of ⅜ in. round rod in the three-jaw, face off, and turn down ¼ in. length to ¼ in. dia., screwing ¼ in. × 40. Centre deeply with size E centre-drill and part off at ½ in. from shoulder. Reverse in chuck, centre, drill right through with No 34 drill, open out and bottom to $\frac{7}{16}$ in. depth with 7/32 in. drill and D-bit. Tap ¼ in. × 40 for about ¼ in. depth and slightly countersink the end. Put a ¼ in. reamer through the remains of the No 34 hole.

### Amount of lift

At ½ in. from the top drill a 5/32 in. hole in the side. Chuck the ⅜ in. rod again, face, centre, and drill to ¾ in. depth with No 40 drill. Turn down $\frac{3}{16}$ in. of the outside to ¼ in. dia. and screw ¼ in. × 40. Part off at ⅜ in. from the shoulder, reverse and rechuck in a tapped bush. Turn down ¼ in. length to ¼ in. dia. then further reduce $\frac{1}{16}$ in. length to a tight fit in the hole in the side of the valve body. Press it in and silver solder it.

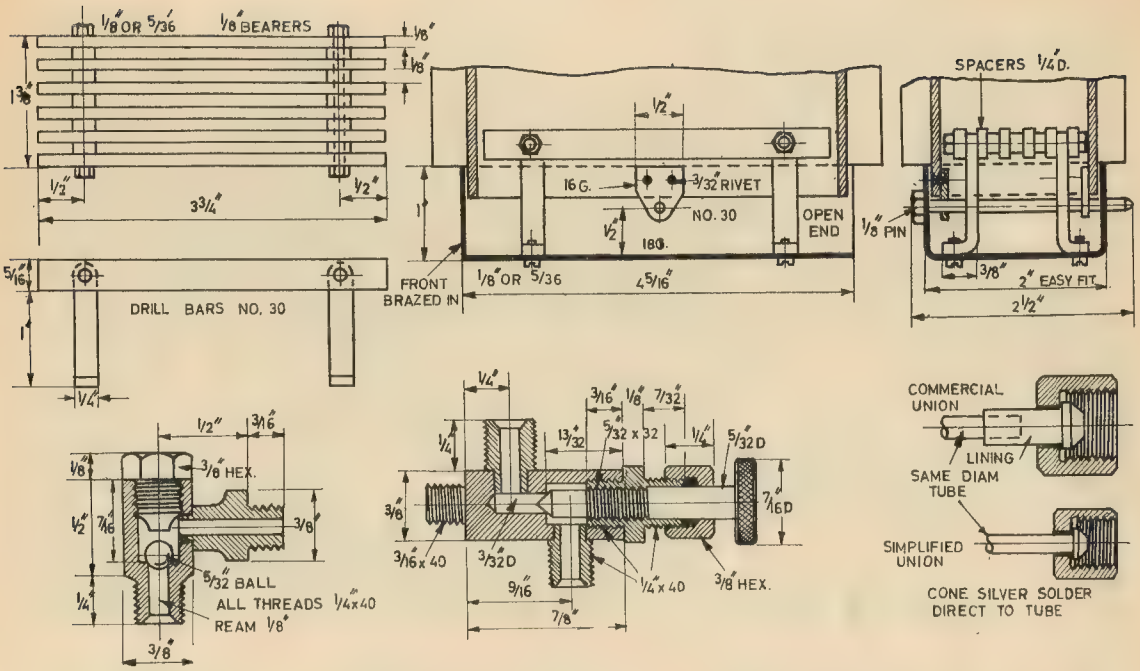
Seat a 5/32 in. rustless ball on the reamed hole, take depth as described for valve-boxes on pump, and turn up the cap from ⅜ in. hexagon rod. Chuck in the three-jaw, face off, and turn to ¼ in. dia. the length indicated by depth gauge, screwing ¼ in. × 40. Then cut back the end until only 5/32 in. of thread is showing. Reduce length by 1/32 in. for the two pump clacks, as pump valves work best with restricted lift, but give the injector clack $\frac{1}{16}$ in. lift as the ball stays up all the time that the injector is feeding, whereas the pump clacks continually bob up and down.

Assemble as shown, then screw one pump clack into the bush on the right-hand side of boiler barrel and the injector clack on the left side. The other pump clack is screwed into a ¼ in. × 40 hole drilled and tapped in the side of the firebox wrapper, through the backhead flange, in the position shown in the view of the complete assembly. The exact height does not matter. Give all the threads a dose of plumbers' jointing.

## INJECTOR STEAM VALVE

This valve has no internal pipe connection but takes its steam from the turret. Chuck a piece of ⅜ in. round rod, face off, turn $\frac{3}{16}$ in. length to $\frac{5}{16}$ in. dia. and screw $\frac{5}{16}$ in. × 40. Part off at ⅞ in. from the shoulder. Reverse in chuck, centre, drill 3/32 in. for ¾ in. depth, open out and bottom to 13/32 in. depth with 7/32 in. drill and D-bit, and tap the end ¼ in. × 40.

At ¼ in. from the solid end drill a 5/32 in. hole into the central hole; at




*Details of the grate, ashpan, check valve, injector steam valve and union nuts and cones*

$\frac{5}{16}$ in. from the tapped end drill another diametrically opposite. In each of these fit a $\frac{1}{4}$ in. × 40 union nipple and silver solder them.

Chuck a piece of $\frac{3}{8}$ in. hexagon rod, face, centre, and drill to $\frac{5}{8}$ in. depth with No 30 drill. Turn down 7/32 in. length to $\frac{1}{4}$ in. dia. and screw $\frac{1}{4}$ in. × 40. Part off at $\frac{5}{16}$ in. from the shoulder, reverse and rechuck in a tapped bush. Turn $\frac{3}{16}$ in length to $\frac{1}{4}$ in. dia. and screw $\frac{1}{4}$ in. × 40. Reverse again in tapped bush, open out the hole with No 21 drill to $\frac{3}{16}$ in. depth and run a 5/32 in. × 32 tap through the rest of it. Screw this fitting into the valve body, tapped end first.

For the valve pin, chuck a piece of 5/32 in. rustless steel or drawn bronze. Turn the end to a blunt cone point—the exact angle isn't of any importance—reduce the next $\frac{3}{16}$ in. to $\frac{1}{8}$ in. dia. then screw the next $\frac{3}{8}$ in. with 5/32 in. × 32 die in tailstock holder. Part off at $1\frac{1}{4}$ in. from the end.

Chuck a piece of $\frac{7}{16}$ in. rod and turn the handwheel, recessing the face between rim and boss as desired. Centre and drill $\frac{1}{4}$ in. for about $\frac{3}{16}$ in. depth, run the parting-tool in about $\frac{1}{8}$ in. depth and, failing a proper knurling-tool, press a second-cut file hard against the edge of the wheel, letting it run along as the wheel revolves, repeating until there is a deep knurl. I do all my wheels that way.

A piece of $\frac{1}{8}$ in. square silver steel with the end hardened is driven through the hole to square it and the end of the pin filed square to fit, the end of the square being slightly riveted over. I usually drill four small holes in the wheel between the rim and boss, for appearance's sake, as shown in the drawings.

The gland nut is made from $\frac{3}{8}$ in. hexagon rod and is the same as a union nut; the whole valve is assembled as shown. It is located on the boiler backhead at $1\frac{3}{8}$ in. from the top and $1\frac{3}{8}$ in. to the left of the centre-line (see view of the cab) which keeps it clear of the water-gauge. At this position drill a 5/32 in. hole in the backhead and tap it $\frac{3}{16}$ in. × 40, screwing in the fitting with the usual taste of the plumber's best friend on the threads.

When right home, the union nearest the backhead should stand vertically: if it doesn't come right and a little gentle persuasion will not help don't strain the threads but put a washer between the fitting and the backhead; the thinnest that will do the trick. Then connect up the upper union to the bottom left-hand union on the turret by a 5/32 in. pipe with nuts and cones at each end.

A suitable $\frac{3}{4}$ in. steam-gauge reading to 120 lb. can be purchased from our advertisers. They *can* be home-made but it is a fiddling job and requires the services of a full-size gauge for calibrating, so it is really cheaper in the end to buy a ready-made one. It is connected to the remaining bottom union on the turret by an inverted swan-neck of $\frac{1}{8}$ in. pipe, as shown in the illustration of the inside of the cab.

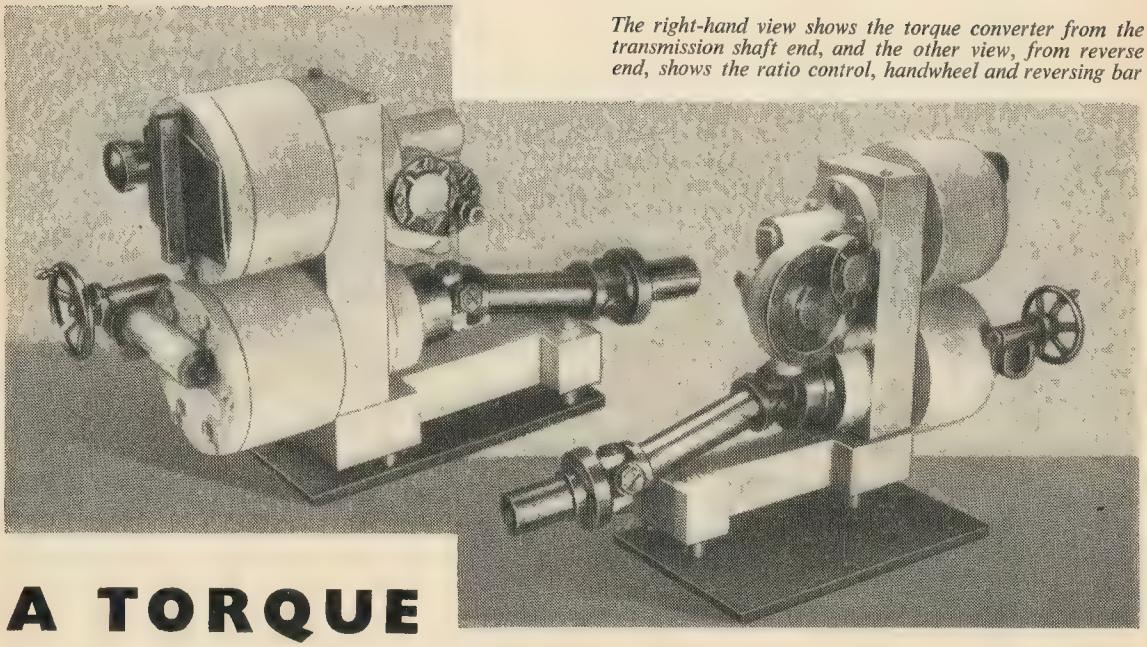
● *To be continued.*

## FOR STEAM LOVERS

You will enjoy reading *The Live Steam Book* by L.B.S.C. It is an invaluable work of reference for all who are interested in building small steam locomotives—and in making them work. Price 12s. 6d. net. Add 1s. postage if ordered direct from Percival Marshall and Co. Ltd, 19-20, Noel Street, London, W.1 (U.S.A. and Canada $3.00).

## MAKE YOUR OWN CLOCK

You can equip every room in your house with accurate and inexpensive timepieces if you follow the instructions in *Electric Clocks and How to Make Them* by F. Hope-Jones. It gives details for building the Synchronome master clock, and it also contains a number of full working instructions in line with current practice. Price 10s. 6d., postage 8d., from Percival Marshall, 19, Noel Street, London, W.1. (U.S.A. and Canada $2.50).



*The right-hand view shows the torque converter from the transmission shaft end, and the other view, from reverse end, shows the ratio control, handwheel and reversing bar*

# A TORQUE CONVERTER

## EDGAR T. WESTBURY considers that hardy annual, the infinitely variable gear

THE DESIGN for a 3½ in. gauge 0-6-0 petrol-driven locomotive, which I described amid all the exigencies and vicissitudes of wartime, was put forward as an experimental venture and it is hardly surprising, therefore, that most of the constructors of this locomotive were themselves interested in experimenting and had some very definite ideas of their own about certain of its details. As a result, several variants of the published design have been produced, differing mainly in the design of the transmission gearing.

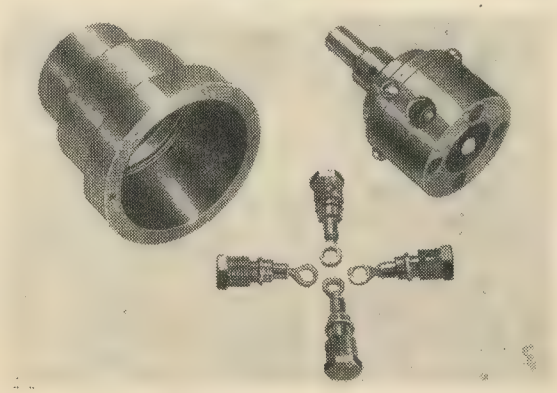
In the prototype from which this design was adapted, namely the L.M.S. shunting locomotive "1831" —originally a steam tank locomotive but later rebuilt with a diesel power unit—the transmission was by means of a hydraulic torque converter, the whole system being largely experimental and therefore subject to the inevitable teething troubles.

As I had no details of the converter and moreover considered that it presented some practical difficulties for construction in a small scale, I decided to substitute a simple mechanical transmission in the form of an infinitely-variable friction gear. Though the latter was heavily criticised at the time it was proved to be fully capable of carrying out its job and, apart from this, it has been adapted by readers for totally different purposes, including machine tool feeds and mechanical testing of brake components.

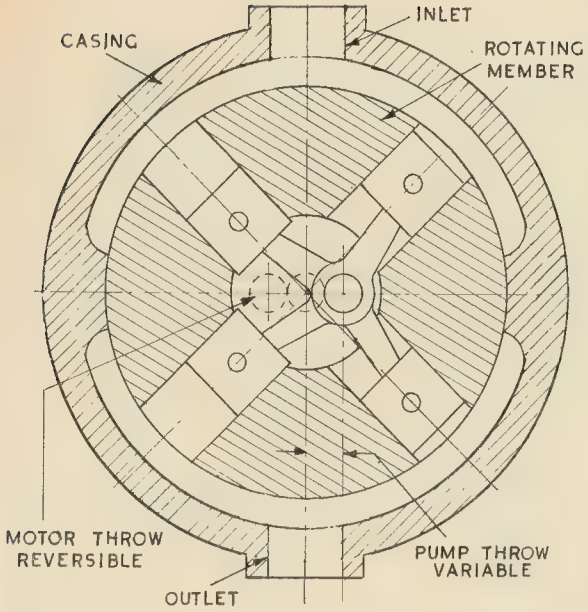
However, there are several possible alternatives which readers have suggested or actually built, such as the three-speed gearbox with tumbler reverse, made and described by Mr Ian Bradley. Only one reader so far as I know has ventured to experiment with hydraulic transmission, namely Mr L. Mackey, of Wilmslow, who has produced a very interesting and practical torque converter on this principle.

For the benefit of the uninitiated it may be desirable to explain just what a torque converter is and why it is necessary. Briefly, it is a device for enabling the required torque or turning effort to be regulated as required to produce sufficient tractive force from an engine having a limited torque range.

A steam engine or electric motor, in which it is possible to obtain almost an infinite range of torque, can be applied to traction duties direct or through fixed-ratio gears; but internal combustion engines which work at more or less constant torque can only be efficiently used for these duties by providing some means of



*One of the pump-motor units dismantled to show the inside components*




*Left: Diagram of the working principle of the pump-motor units used in the torque converter described*

varying the ratio of engine speed to the track wheels.

An ordinary motor-car gearbox is a form of torque converter—though not usually classed as such—having fixed steps of varying ratio; the term, however, is usually confined to stepless or "infinitely variable" transmissions, whether mechanical, electrical, or hydraulic.

In the former class, various arrangements of friction drives and expanding-pulley belt drives are used; electrical devices usually incorporate some combination of generator and motor, though the single-unit type is not much in favour these days. The hydraulic type is a combination in some form or another of a pump and a motor. The series of articles on rotary pumps and motors, published in 1955, gave an outline of the principles involved and details of certain types of hydraulic units.

**"Pros and cons"**

While the hydraulic type of torque converter is very smooth and flexible in control and provides a sufficiently wide speed/torque range to cover practically any eventuality its mechanical efficiency is lower than certain other types by reason of fluid friction, or "oil drag," as it is more often termed.

I once worked for a firm which spent several years in developing a hydraulic transmission for motor cars; it worked very well indeed but the top gear performance was much lower than that of the normal gearbox and therefore it was not a commercial success.

For many purposes, however, it is worth while to sacrifice something at the top end for the sake of convenience and facility in starting heavy loads from rest, or obtaining any speed ratio from zero to maximum; and in this respect the hydraulic transmission excels.

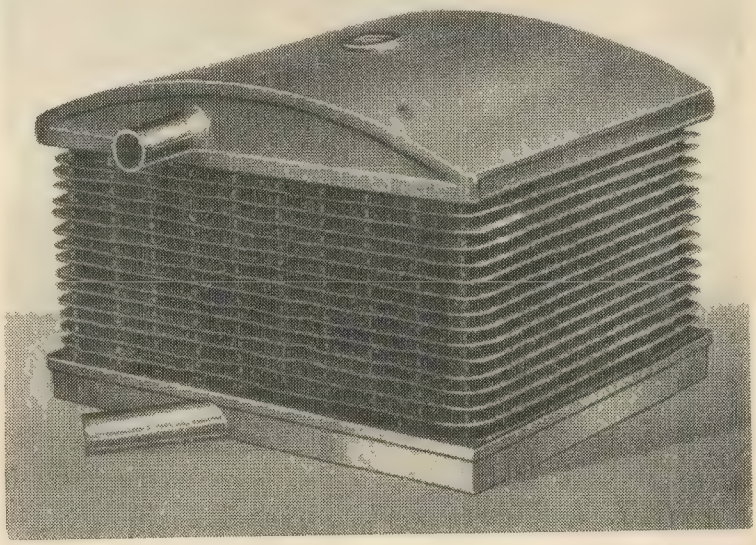
Perhaps it may be advisable to point out that a clutch, whether mechanical, electro-magnetic or hydraulic, is *not* a torque converter, though it enables the transition of speed ratios to be taken up gradually and smoothly. The so-called fluid flywheel is capable of torque conversion over a limited range, as it consists of a centrifugal pump and an inward-flow turbine in a single casing; but it is usually employed in conjunction with a multi-speed gearbox rather than as a substitute for it.

**Experimental transmission system**

Mr Mackay's torque converter consists virtually of two units, though they are permanently mounted adjacent to each other and are very much alike, both externally and internally, except for certain details. Both the pump and the motor rotate bodily and carry four radial cylinders in which are fitted plungers with short articulated connecting rods.

The cylinders are staggered endwise to enable the eyes of the rods to be located side by side and to fit on a single stationary crankpin. Therefore, if the latter is eccentric to the axis of the rotating member the plungers will be given the equivalent of a reciprocating motion in their individual cylinders so that displacement of the working fluid takes place. No inlet and outlet valves are necessary as the rotating member acts as a rotary valve to control these events; the unit is thus suitable to act either as a pump or a motor. Reversal of flow can be obtained by reversing either rotation or the "phase" of the crankpin.

The pump, which is the lower of the two units, is driven from the engine by the universally-jointed shaft, and its outer endplate has a slide carrying the crankpin (strictly speaking, this should be termed "throw pin") so that its eccentricity may be varied from zero to maximum and thereby control the output of the pump.



*Below: The multi-tube radiator for "1831"*

## TORQUE CONVERTER

This adjustment is controlled by a screw, operated in turn by a worm-geared handwheel in a position accessible to the driver. When the displacement of the pump is small the torque load on the engine is relatively light and it is able to keep up its speed so as to build up enough pressure to operate the motor against heavy tractive resistance. With full displacement, however, the increased output of the pump will drive the motor much faster for a given engine speed and thereby handle normal running load.

The motor is located above the pump, and its crankpin, instead of being capable of variable adjustment, is operated by a radial lever to give three positions only; that is, full throw right for forward, centre for neutral, and full throw left for reverse. Power from the motor is taken through worm and spur gearing to a sprocket for driving by miniature roller chain to the locomotive jackshaft.

The vertical standard carrying the pump and motor is hollow and serves as a reservoir to keep the system completely filled with fluid at any time; as it is not under pressure it could be topped up while working. Escape of fluid from the pump and motor is prevented by seals fitted to both shafts. Any of the usual hydraulic fluids can be used, including low-viscosity lubricating oils and oil-water emulsions; the objection to using water alone is its lack of lubricating quality and liability to cause rusting.

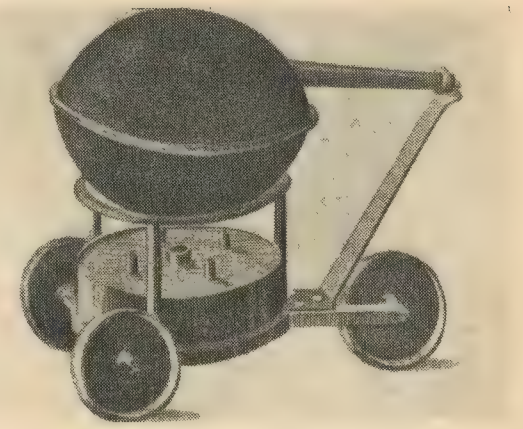
Tested on the bench, the converter gave very good results, producing a motor speed practically equal to that of the pump on full throw, down to an almost imperceptible creep with very high torque as the throw was reduced; it performed equally well when driving the motor in either direction of rotation, the pump running at uniform speed in the same direction throughout. While I have not seen it applied to its intended purpose on the locomotive I have no doubt that it would be quite successful and a pleasure to drive.

Another modification which Mr Mackay is incorporating in his "1831" locomotive is a radiator for engine cooling in place of the surface evaporation tank specified in the original design. This is of the vertical-tube type with a large number of tubes passing through a bank of equally-spaced plates to serve as cooling fins, connecting an upper and lower reservoir or header.

Comparatively few constructors, so far as I know, have succeeded in making really efficient small radiators; there are some very tricky assembly and soldering operations involved and I shall be very interested to see how Mr Mackay's courageous venture works out in practice. ▣

# JET PROPULSION IN THE 18th CENTURY

### BY H. H. NICHOLLS



*Jet-propelled model car of the 18th century*

AMONG the novelties offered by London Philosophical Instrument Makers was a little model car illustrating jet propulsion; this was in the catalogue of W. and S. Jones of Holborn, in 1799. It is shown in the illustration, and it will be seen that there is no filling plug.

Evidently the amusement was to put the spout under water, having first warmed the boiler so that it sucked up some water, a process which was repeated until there was enough in the boiler. The lamp was then lit and the cork firmly pushed into the spout, this cork being of course soon blown out.

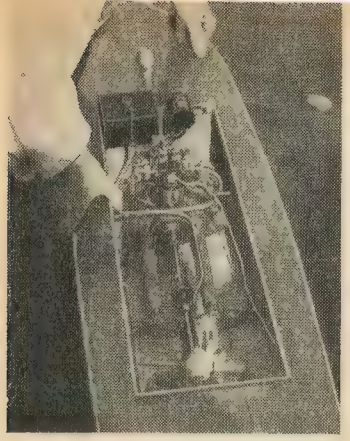
If the wheels are free, such a jet model will then shoot across the floor; a good lecture-room demonstration, but one cannot imagine that it was popular with the parents of the eighteenth century schoolboy.

It will be noticed that the boiler rests on a ring and is only held or clipped at the end of the spout, the whole being most strikingly adapted for the purpose in view; these philosophical instrument makers of the eighteenth century were brilliant men and performed work of the greatest value in making the ideas of the age intelligible to the public. In this they received a great measure of encouragement from the sovereign of the day, King George III.

The work of these instrument makers was done without any gas supply; they had to braze on a charcoal hearth and silver solder in the same way. The turner had to be a great expert in such an establishment, and it will be seen that the boiler of the jet-propelled car is made of two spinnings brazed together by the edges.

Everything had to be done with hand tools; there were no taps and dies to be bought; only expensive "carbon steel" from which the mechanic must make what he require for any task.

The moulder took the greatest pride in his brass castings, which were admirable in much of the old work, especially the frames of the early navigating instruments. The modern mechanic, whether professional or amateur, can learn much from the productions of Jones, Cary, Dollond, and Adams, who were the principal manufacturers of these goods in eighteenth century London. ▣



**Some of the more important considerations which the tyro needs to fully understand**

# POWER BOATS for beginners

*By RICHARD MAPPLEBECK*

A QUESTION to which a newcomer expects a straightforward answer is: "What sort of power unit shall I need?" My answer is usually another question: "What sort of boat are you constructing?"

Ignorance of power plants and their capabilities as well as hull design can lead to all manner of troubles and disappointments. A novice would neither want nor expect to see a tug careering along as if all the devils from the nether regions were after it, nor for that matter a model liner creeping along unable to hold steerage way.

Consider the mass and inertia of the hull. These are reduced to scale values by the modeller but there is no corresponding change either in the physical properties or application of natural forces applied to the hull. The qualities of wind and water are not scaled down. The model boat must be designed to hold its own in mediums that tend to take control of its movements to a much greater extent than in the full-size job.

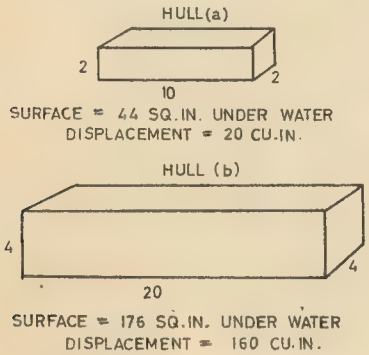
It might appear on the face of it that a long, narrow and deep draught boat would be less affected by wind than one of hard chine construction, or one of comparatively shallow draught. This is possibly true at slow speeds, therefore the shallow draught boat must be made to move quickly if it is to be a straight runner, and superstructure must be kept to a minimum.

On the other hand, a deep draught hull can be influenced by disturbances in the water that would not affect a shallow-draught boat, especially at regattas where so many wading competitors cause quite violent underwater eddies. If, by the very nature of the design the boat must have a deep draught, a heavy one will tend to overcome deflecting currents.

A model battleship or liner can be propelled by an i.c. engine, but steam would offer the better medium from the spectacular point of view and because the power plant would be heavier. If carefully laid out it would provide a low centre of gravity with increased stability.

To preserve the trim of a craft, always mount the power plant as low as possible; the lower the centre of gravity the more stable will the craft be. This applies particularly to deep narrow hulls.

*Diagrams illustrating how displacement increases in relation to size*




## RUDDERS

Many beginners fail to realise that making the rudder to the same scale as the boat is not always a good policy. It is a natural thing to do, but if some thought is given to the matter it will be realised that a small true-to-scale rudder moving at possibly greater than scale speed through the water will still not be influenced sufficiently to exert adequate steerage.

It is usually found necessary to increase the rudder area out of all proportion to scale size. Some power boat men frankly discard normal rudders altogether in favour of two large steering fins screwed to either side of the hull. The total area of such fins may be ten times that of a scale rudder.

This assumes the craft will be used for straight running only. Even so, if it is desired to put the ship on a circular course it is quite a simple matter to drill a couple of holes at the trailing edge of the fins and attach temporary deflecter plates.

Radio control regattas reveal that serious competitors seem to place their faith in diesels and four-stroke engines driving fast launches. But for the beginner, electricity gives results that open up avenues for advancement and on that ground it is not to be despised.

## ENGINES

If it is to be a good steerer considerably more power will be required to drive a shallow-draught boat than a similar size deep-draught boat on account of the higher speed required to make it plane.

There are a number of small commercial kits on the market which, when assembled, are about one metre in length. They put up a very good performance when driven with c.i. engines of about 2½ c.c. to 3 c.c. capacity. For the tyro with little or no workshop facilities these engines are a real boon. The only disadvantage is the comparative expense of diesel fuel. However careful the operator, it is not long before most of the inside of the craft becomes coated with fuel and oil which invariably acts as a good paint stripper.

Petrol engines are cleaner to operate and the four-stroke type is much quieter. With their flexibility, they offer a power unit that can be used to advantage in many types of boat. Such engines are often beyond the skill of the newcomer to construct. How then can they be obtained?

Occasionally they are advertised for sale in the advertisement columns of this journal or engines of limited design can be obtained from one or two of the leading model shops. Prices vary from about £2 for a small diesel to about £15 for a good 10 c.c. or 15 c.c. four-stroke.

A shallow-draught launch of about 36 in. length needs at least a 3 c.c. diesel to make it plane over the water satisfactorily. Larger launches up to 60 in. need a 30 c.c. motor for the best results, but smaller engines will drive such boats at slower speeds if the owner does not object to their ploughing through the water instead of planing.

One has to bear in mind that hull resistance increases rapidly with increase in size and doubling the length of a hull while keeping to the same shape means that the motive power may have to be cubed. Two prominent factors governing this are illustrated in the diagram where a rectangular shape has been chosen for simplicity of calculation and ease of demonstration. There are of course other points for consideration but these two are important.

Assume the waterline to be halfway up the hull, then:

Boat (a)

Surface under water will be = $(1 \times 10)2 + (1 \times 2)2 + (10 \times 2)$ sq. in.

= 44 *sq. in. under water.*

Displacement = $2 \times 10 \times 1$ = 20 *cu in.*

Boat (b)

Surface under water = $(2 \times 20)2 + (4 \times 2)2 + (4 \times 20)$ sq. in.

= 176 *sq. in. under water.*

Displacement = $4 \times 20 \times 2$ = 160 *cu. in.*

In the case of steam, the pressure, its dryness and the cut-off are important points assessing an engine's capabilities. With i.c. engines, some variation in output can be expected between diesels, two-strokes, side-valve and overhead-valve types of the same capacity.

Running costs are not a very expensive item and apart from such things as oil and the occasional renewal of spark plugs, fuel is the heaviest. A gallon of petrol will last an i.c. engine a very long time, probably a whole season. Petrol blowlamps used in steam plants can be comparatively extravagant and an afternoon's steaming for a large boat may consume a pint of fuel.

Consumption of methylated spirit for small boats might be half a pint for an afternoon's running and coal would only amount to a pound or two. Diesel fuel is most expensive bulk for bulk, but fuel consumed by very small diesels is not so serious as might at first appear. Fuel costs can be very high for the special high-efficiency fuels used by the hydroplane experts who mix their fuels to their own formulas as often as not containing such elements as nitro-methane and nitro-benzine, which may cost as much as several shillings for each $\frac{1}{4}$ mile run round the pole.

For anybody just starting with a small diesel an ordinary bottle of commercial fuel is sufficient. This fuel usually contains ether so never bench test without plenty of ventilation to release the fumes.

It is a waste of time trying to start a diesel on stale fuel because the volatile element will probably have evaporated. It will prevent frayed tempers and many a blistered finger if old fuel is thrown away and new purchased.

## ENGINE POSITIONING AND SHAFTING

In trying to avoid a sharp angle between crankshaft and propeller axes, many people mount the engine towards the bows. If the boat is a surface hull, such as a high-speed launch, and it is desired to make it plane, this is an important point to watch inasmuch as excessive weight forrard will tend to hold the bows down instead of allowing them to rise. To a lesser extent the same thing applies to deep hull craft which, instead of riding well in rough water, will plough through the waves.

Engines can be tilted slightly as in full-scale practice to reduce the shafts, coupling angle. This angle is usually not more than 6 deg., but nevertheless some people prefer to utilise flexible shafts instead and retain their power units on an even keel. Flexible shafts are not very reliable, as the propeller only needs to strike a submerged object to buckle the shaft, which usually means a replacement.

## PROPELLER SHAFTS

Gunmetal or bronze bushes are best for supporting the propeller shafts, though brass will do if nothing else is obtainable. Recently, Tufnol, a type of fabricated bakelite, has become fairly popular for this function especially among the high-speed exponents.

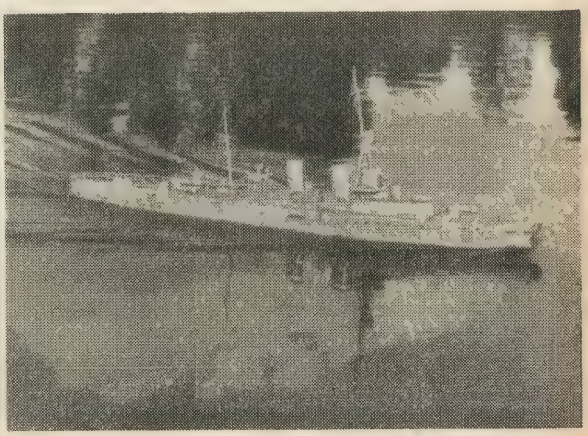
It is wise to remember that a 30 c.c. engine may develop nearly one horsepower and is not exactly a toy. The same applies to a lesser extent to smaller engines. Flimsy construction is a waste of time and causes endless trouble at the lakeside, apart from the fact that there may be a risk of personal damage.

The shafts should preferably be made of stainless steel but if this cannot be obtained silver steel is the next best material. It is not advisable to make the shaft of too small a diameter if it is fairly long or it may develop whip at high r.p.m.

Engines of the larger categories often use $\frac{1}{4}$ in. dia. shafting and may

*Left: The advantages of being in a club. Plenty of help is forthcoming to the beginner in trouble*

*Below: A bread-and-butter hull, twin-screw driven by a 12 v. $1\frac{1}{2}$ amp motor. The accumulators set this craft too low in the water*



*Neat engineroom layout with the motor not too far forrard*

easily be 14 in. in length. Engines up to 15 c.c. need only have $\frac{3}{16}$ in. shafts, while smaller types up to 5 c.c., about $\frac{1}{8}$ in.

The shaft casing should be filled with grease and a watertight gland screwed on the propeller end. If the inner end is above the waterline a gland will really not be essential, but if the shaft is not stainless steel it is just as well to fit one to prevent rust from forming. Many power boat men fit one both ends, and this is really necessary if the boat is to be used in salt water.

## HIGH OR LOW R.P.M.

Considerable controversy is always taking place regarding the best propeller speed for a particular craft, and although cavitation will be put forward as an argument in favour of slow r.p.m., in actual practice this does not seem to have much effect owing to the scale-down rate of water displacement at the blades.

Many owners of straight-running craft use propeller speeds up to 10,000 r.p.m. with a small screw of fairly shallow pitch, but others favour larger and coarser pitch blades running at fairly low speeds, about 1,000 r.p.m. or even less. Such slow revolutions are usually confined to slow-running, heavy boats whereas shallow-draught boats which may run at 8 to 10 knots would use the high r.p.m.

To quote an extreme, hydroplanes frequently run at revs as high as 19,000 r.p.m., using a very coarse pitch propeller. In this case, any tendency to cavitation is broken up by the intense turbulence.

For small electrically propelled boats, the blades of the propeller need only be soft soldered, but larger craft should have theirs brazed or silver soldered.

## HULL CONSTRUCTION

There are three popular methods of hull construction, namely bread and butter, planking and sheet material covered.

Many constructors make do with the sheet-ply or tinplate method as it makes for easy work. All that is necessary is to make a skeleton hull of keel, bulkheads and stringers and cover the outside with the material chosen. The rigidity of these materials makes it difficult to obtain orthodox lines but quite good hulls can be made if a little trouble is taken.

Bread-and-butter construction implies the screwing together of a number of planks. The resulting block is then carved to the desired shape, the correct lines being obtained by a number of templates made to the information on the drawing. The planks are then separated and the individual boards sawn round their edges. The outer pieces are fastened together either by being glued or screwed into their original positions thus forming a hollow shell.

Planking seems to be least popular and consists in laying planks along the ribs of a skeleton frame of bulkheads and stringers. Hull lines are somewhat restricted by the degree of twist and bend that can be induced into the planks, but if a soft wood such as obechi is used, for which $\frac{3}{8}$ in. $\times$ $\frac{1}{8}$ in. planks are usually available, quite good lines can be obtained. The sharper corners are negotiated by steaming the planks while bending and twisting as required.

After the planks have been pinned and fixed with a waterproof glue, the whole of the outer shell can be painted thickly with the glue and a layer of muslin stretched on.

## MAKING THE HULL WATER-TIGHT

Some owners proudly boast that the component parts of their hulls are held together with the new plastic resin adhesives and that there "isn't a screw in them." But the beginner will probably want to go slow for a while and try the more orthodox methods of screwing and gluing, and in this connection always use brass screws. Steel and iron tend to rust.

As far as planking is concerned, the muslin and glue will ensure fairly good water-proofing. Painting will probably be enough after that.

A good way of keeping a bread-and-butter hull from leaking is to mix up a paste of red lead and goldsize (the butter) and spread it between the wooden layers (the bread). These are then screwed together whereon the paste will squelch out at the seams but it will result in a water-tight seal.

## COST OF HULLS

Timber is a high price today. This fact alone can influence the choice of a hull. For bread-and-butter jobs obechi is the lightest for a good grain with reasonable toughness. It cuts easily too. For a boat about 5 ft long it is a good plan to use 1 in. boards which might cost up to 2s. 6d. per ft run of 8 in. board, bringing the price into the region of £3 10s.

Suitable planking in obechi $\frac{3}{8}$ in. $\times$ $\frac{1}{8}$ in. can be purchased for about 4d. per 3 ft length; £1 for 80 planks. On the debit side must be included the cost of making up the bulkheads and stringers which might easily add up to 15s.

The plywood or tinplate method is the cheapest but as previously related it is virtually impossible to obtain nice clean lines owing to the difficulty in bending the material. There have been occasions with plywood hulls when well-finished boats have had their sides stove-in by kicks from careless spectators, whereas tin only dents in such circumstances. Also, tin cannot catch fire.

It should be explained, however, that there is little risk of fire, and most model engineers employ wood withou ta hesitation.

## FINISHING

To be of any use, a finish needs to be proof not only against water but liquid fuels also. It is not known by the author whether there is an enamel or paint on the market that will stand up to diesel fuel. All the ordinary brands seem to peel off on contact, some sooner than others. Not so, however, with petrol, paraffin or meth.

A good enamel used by many old hands is Robbialac Synthetic or Robbialac Shell. Five or six coats of this, each coat rubbed down with fine, wet sandpaper after it has hardened, will give a good surface, the final coat being rubbed up with metal polish. A flat lead primer should be put on first for best results with many finishes but it can be dispensed with in the case of the brand of enamel just mentioned. ▣

# READERS' QUERIES

**Do not forget the query coupon on the last page of this issue**

**This free advice service is open to all readers. Queries must be on subjects within the scope of this journal. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling, cannot be given: stamped addressed envelope and query coupon with each query. Mark envelope "Query," Model Engineer, 19-20, Noel Street, London, W.1**

## Flash steam boilers

Could you supply me with information on flash steam boilers?—A.R.B., Tonbridge, Kent.

▲ *The essential feature of these boilers is that they are made in one single and continuous length of tube, through which the water passes and is progressively heated and turned into steam. Most flash steam boilers used in model engineering practice consist of a coil of tubing in one or more layers inside an asbestos-lined casing and heated by means of a blowlamp, the flame of which passes through the inside of the coil.*

*The Percival Marshall handbook "Flash Steam" contains a great deal of practical information on all types of flash boilers and suitable engines, but, unfortunately, this is at present out of print, though you may possibly be able to obtain a copy through a bookseller or by advertising in the small ads columns of* MODEL ENGINEER.

## Manufacturing cylinders

I am about to attempt to build a 3½ in. gauge engine to L.B.S.C.'s drawings for *Petrolea* but I see that the firm of A. J. Reeves and Co. are charging about £2 for sets of cylinder castings—and this is stretching my finances.

I have tried to obtain gunmetal in bar form (2 in. × 2 in. × 3 in.), which apparently would run out at about half the cost of castings, but Smiths of Clerkenwell tell me that I will not be able to get the material in this size. They can, however, supply phosphor-bronze of a suitable size and so as this appears to be metallurgically nearly the same as gunmetal I wondered whether it would be suitable to use instead.—W.H., Thornton Heath, Surrey.

▲ *Phosphor-bronze bar would be quite suitable material for manufacturing the cylinders for the 3½ in. gauge engine* PETROLEA. *However, an even simpler and cheaper method of construction would be to fabricate the cylinders from phosphor-bronze tube of suitable size. This has often been successfully done by other constructors.*

## Motor trouble

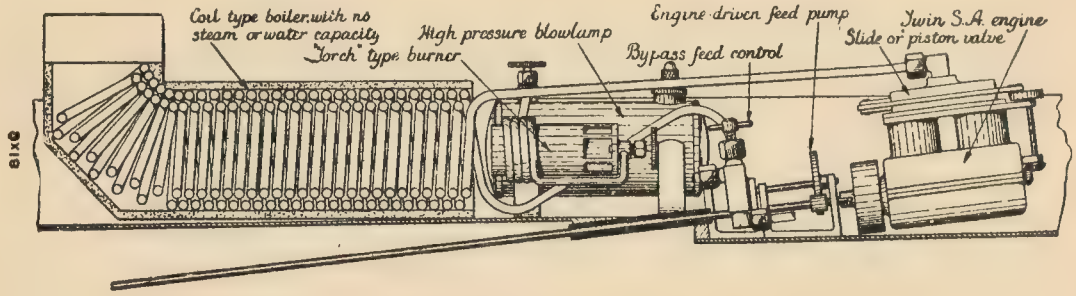
I have a band saw which is powered by a Hoover ¼ h.p. motor controlled by an internal centrifugal switch. While using the machine recently the saw became fastened in the work and the motor stopped. Since then the motor is difficult to start—even with no load—and makes a burring noise. However, on giving a slight push with the hand, the motor quickly appears to gain full power and speed.

I took the precaution of taking the motor to a local electrician, but beyond cleaning it he does not seem to have achieved any results.

If the leads are changed over, the motor runs in the opposite direction. I have always understood that a.c. motors are not so easily reversed.—F.B., Bishop Auckland.

▲ *It would appear that the fault is in the starting windings of the motor. (This would account for the fact that when given a start it will run up to full power and run normally.) It would be fairly easy to test out the continuity of these windings to verify this matter.*

*With reference to the effect of changing over the leads, you will find that whether or not the leads are changed over, the motor will run in either direction according to which way it is started. It is quite impossible that the changing over of the leads can reverse the motor directly. Under normal conditions, changing the starter leads only is the method employed for reversing these motors.*

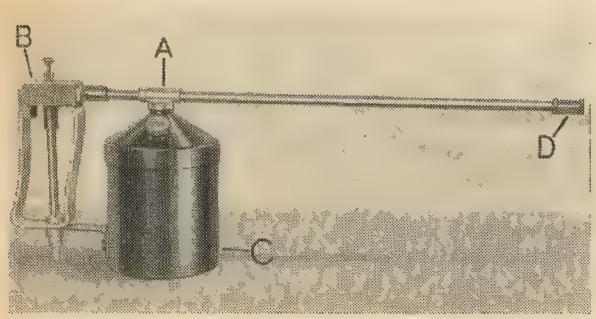



*Typical arrangement of a flash steam plant in a model racing boat*

## Transfer tip

Can you give me an address of a firm supplying transfers for the gold lining of tanks and cylinders of a 7¼ in.-gauge locomotive?—F.B.R., Sidcup, Kent.

▲ *There is no firm at the moment supplying special transfers for lining tanks, etc., of a 7¼ in.-gauge locomotive. However, a scheme which is frequently applied to this sort of thing consists of applying the transfers sold by cycle dealers for decorating bicycles. Several instances of large-scale model locomotives which have been decorated successfully in this manner are on record, and it is possible to obtain a fair selection of different styles of lining from any good cycle dealer.*




## Expert's Workshop

**This week DUPLEX begins a series of three articles telling how to build**

# A PAINT SPRAY GUN

A RECENT ENQUIRY reveals an interest in the MODEL ENGINEER paint gun. The spray gun, which forms the subject of this article, closely follows the original M.E. design—and as I have made a number of these guns I can testify to their effectiveness; they were described by me in two articles published on 11 and 25 January 1951, respectively.

Readers interested in the tool may be able to refer to these articles, but for those who are unable to do so here is a short description of the operating principles.

As will be seen in the general arrangement drawing (Fig. 1) the gun consists of three main assemblies consisting of the body, *A*, the stock, *B*, embodying the control valve and the container, *C*. The gun is of the high-pressure type operating on the injection principle—that is to say that the paint, or whatever liquid is to be discharged, is raised from the container by suction. It is then conveyed to the spray nozzle, illustrated in Fig. 2, where the liquid is mixed with air and sprayed on to the object to be cleaned or painted.

### THE NOZZLE

The nozzle itself consists of three parts, a combining cone, *D*, screwed directly on to the tube, *A*1, an air jet, *D*1, and an air tube, *D*2; this last is fed from the air line by way of the control built into the stock of the gun.

As soon as air is allowed to pass through the air jet a depression takes place in the combining cone and the body of the gun because of the injector effect caused by the air rushing from the jet. Thus any fluid in the container will be drawn up the paint tube and delivered to the combining cone where it will be mixed with the air and expelled from the gun.

Fig. 2 depicts the combining cone, *D*, screwed against the air jet, *D*1. In these circumstances no fluid will be withdrawn from the container because the necessary depression behind the combining cone cannot occur. However, as soon as the cone is screwed away from the air jet and the air is turned on, a depression will occur and paint will be drawn into the combining cone and sprayed from the nozzle as in Fig. 3. It will be clear then that, by moving the combining cone axially in relation to the air jet, the intensity of the jet can be varied at will.

The maximum volume of liquid that can be sprayed is quite considerable. On the other hand the liquid delivered can, when required, be reduced to a very fine spray of small volume. Once the correct volume of spray has been set the combining cone is secured by the locknut.

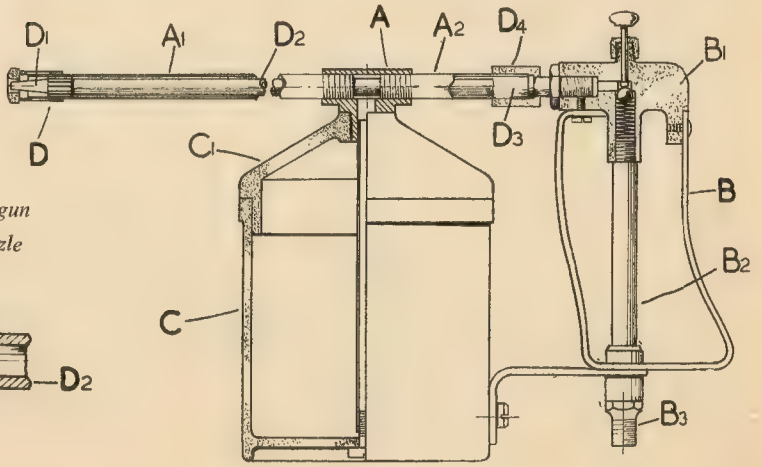
The spray gun illustrated was made to carry out some experiments in the formation of oil mists; it has since been used for a variety of purposes, ranging from the painting of components to the spraying of paraffin and other cleaning fluids. The working pressure is about 50-60 p.s.i.; at this pressure all thin liquids are finely atomised.

### MAKING THE GUN

When making the gun it is best to start with the container, *C*, the details of which are given in Fig. 4. This component can be made from the solid, if desired; but this procedure is certainly not essential provided that the container is fully strong. In this connection it should be borne in mind that the base is secured to the cap of the container by a hollow stud that also forms the paint tube through which the pigment is conveyed to the nozzle.

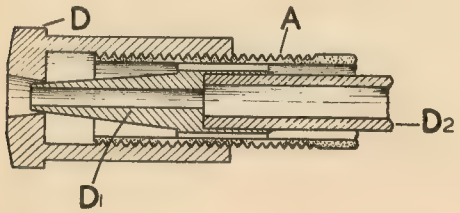
The cap, *C*, is best made from solid material. If a suitable piece of light alloy is not to hand, a rough casting can be made by melting down old car pistons and casting the metal in a tin.

The piece of bar or the casting for the container, *C*, is first machined over its outside surface, the work




*Right, Fig. 1: Sectional view of spray gun*

*Below Fig. 2: Details of the spray nozzle*



being held in the 4-jaw independent chuck and supported by a centre mounted in the tailstock. The component is then reversed in the chuck so that the interior may be bored to size, following which the container is removed to the drilling machine where a 7/32 in. dia. drill is fed into the centre-drilled hole used for supporting the work during the first operation.

The cap itself is machined, first, by forming the $3\frac{1}{8}$ in. dimension and the abutment shoulder for the container. The interior and the $2\frac{7}{8}$ in. dimension are next machined together with the $\frac{1}{2}$ in. × 26 t.p.i. thread forming the seating for the body of the gun.

After these operations the work is reversed in the chuck so that the top surface of the cap can be turned. The $\frac{1}{2}$ in. dia. × 26 t.p.i. thread for the stopper, *C2*, is easily located and machined in the lathe if the cap is attached to a vertical slide mounted on the lathe topslide or cross-slide; the vertical slide can then be swung round to bring the sloping surface of the work parallel to the face of the lathe chuck as illustrated in Fig. 5.

A very light cut by an end-mill over the surface of the cap at the point where the stopper is to be placed will enable the centre of the $\frac{1}{2}$ in. dia. tapped hole to be accurately located and the work adjusted to the correct height by means of the cross-slide and vertical-slide feed screws, respectively.

A centre drill followed by a pilot drill and, next, the tapping size drill can then be fed into the work. Finally the seating for the stopper is machined either with an end-mill or boring bar held in the chuck.

The work can then be threaded by means of a tap also held in the lathe chuck.

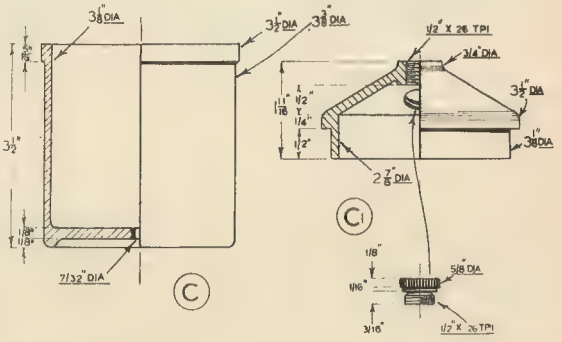
The making of the stopper itself may be from any convenient material to hand.

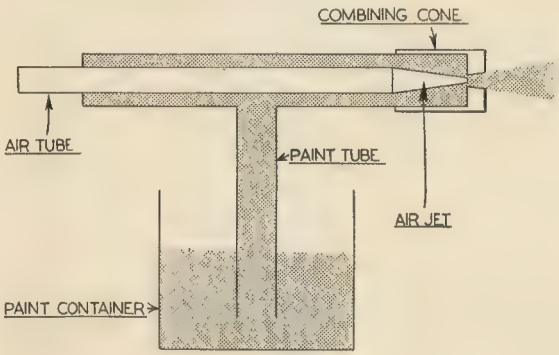
● *To be continued.*

*Right, Fig. 4: Details of container*

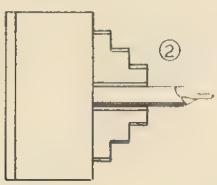
*Below, Fig. 3: How the spray gun works*

*Below, right, Fig. 5: The method of machining stopper hole*

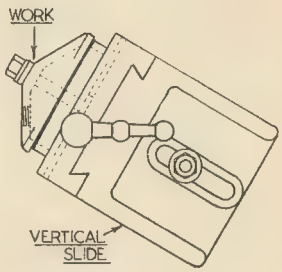



① END MILL




③ PILOT DRILL
④ DRILL TAPPING SIZE
⑤ SPOTFACE
⑥ TAP




# A POCKET SCRIBEDRIVER

THERE are not many tools which the model engineer can carry in his pocket like a fountain pen. One of them, with a pocket clip attached, is the combined scriber and screwdriver devised by Moore and Wright (Sheffield) Ltd whose address is Norton Lane, Sheffield 8.

The scribedriver, as it is called, has blades of carbon steel, properly hardened and tempered, and a black plastic body with a knurled chuck at one end. A machined tang on the screwdriver blade fits positively in the chuck and resists turning.

Before the tool is clipped to the pocket one of the blades can be reversed in the chuck and telescoped inside the body. The remaining blade is accommodated at the other end, which is drilled out and fitted with a screw cap.

Chuck and clip are nickel plated, and the whole makes a tool as attractive as it is useful. It costs 4s. 6d. ▣

# POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

## CONTROLLING RELAYS

SIR,—Further to J.G.P.'s problem [Readers' Queries, September 13], I should like to submi tthe following as a simple and reliable method of doing what is wanted, and it should be cheap enough, considering the surplus market. It relies upon the operate and release lags of two or more relays fitted with copper slugs.

Sketch *A* shows a relay fitted with a copper slug at its armature end. Such a relay will be slow both to operate and to release. The bigger the slug the longer the lag. The slug itself is a solid cylinder of copper, the same diameter as the relay coil and up to about 1½ in. in length. It is bored axially to fit over the relay core, beside the coil, which is, of course, reduced in length to allow this.

A similar effect, but much less in extent, can be obtained in relays with two or more coils if one coil be short-circuited, and even in a single coil relay, slow release can be obtained by operating the relay coil via a resistance and bringing about the release by shortcircuiting the coil.

Again, the operate time can be increased a little, without prejudice to any slow-release, by operating the relay through a resistance and arranging for that resistance to be short-circuited by one of the relay's contacts. These dodges can help, as can condensers in strategic places, but their effect is small compared with that of a slug.

The circuit, sketch *B*, consists of two relays, having each a slug at the armature end, a battery, which could just as well be that for the external circuit and a switch, *K*. The relays are designated *A* and *B*. *A* has two make spring-sets and *B* has one break. (These are usually interchangeable and can be swopped around from relay to relay till you get what you want).

Current flows from the battery, via switch *K*, contact of *B* and coil of *A* to other side of battery. After due operate lag, *A* operates and completes the circuit for operating *B*. *B* operates (after due operate lag) and breaks the circuit for *A* which will, of course, release (after due release lag). Release of *A* breaks the circuit for *B* which, in turn releases (after due release lag) and we go back to the beginning.

If the relays are of the same type, and are in similar adjustment a 50/50 make/break ratio will result, and will, of course, control the external circuit at *A*'s second pair of contacts. It will be seen that the dwell of *A* in the operated or unoperated position will be the sum of *B* operate time + *A* release time or *A* operate time + *B* release time. Thus, if the operate and release lag of each relay were, say, ¼ sec., the result would be 60 makes and 60 breaks per minute. Even slower operation would be possible.

Ten amperes is, I think, much too high a current for an ordinary relay, even at 12 v. with a resistance load, and I would suggest the use of a small contactor obtainable from the surplus market. In any case, if the duty-cycle is of any length, a spark-quench would be desirable both on the relay contacts and on the contactor, if used.

Assuming the 12 v. referred to is also used on the relay coils, these should be of about 100-200 ohms, though this should not be critical, and I suppose down to 50 ohms and up to about 300 ohms should be all right.

Adjustments of relays: Armature travel, adjust by altering the angle of the bend where it rides on the knife edge—range about 10-35 mils on a typical relay. The greater the travel, the slower to operate. Residual gap: If a screw is fitted, the smaller the gaps, the slower to release. Spring load: The greater the spring tension, the slower to operate, but the quicker to release.

Glasgow. JAMES J. BROWN.

## MAKING CHARCOAL

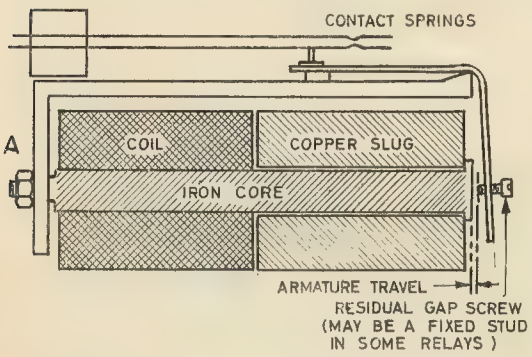
SIR,—One frequently reads of the difficulty of obtaining charcoal for small solid fuel boilers. Out here we use the following method for small quantities:

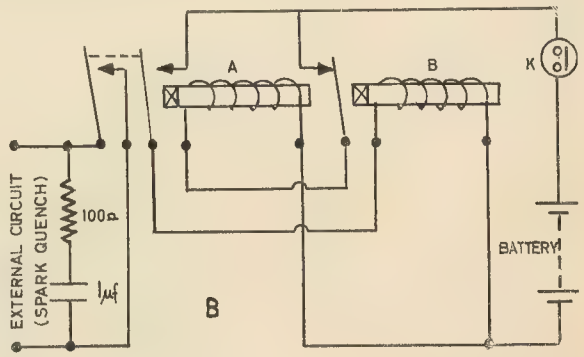
Obtain a 40/44 gal. drum. One end usually has a 2 in. bung and ¼ in. air breather. Punch in two more holes about 2 in. dia. (or square) making four in all, equally spaced.

Cut out the opposite end of the drum with a chisel and retain it. At this end of the drum drill four ¼ in. holes about 2½ in. below the lip of the cut. These holes should be 90 deg. to each other. Bolt in four ¼ in. bolts and nuts, the ends projecting into the drum about 1 in. About ½ in. above these drill a further four holes of say $\frac{5}{16}$ in. dia. These are to thread two ¼ in. bars through.

The drum, its cut-out bottom and

*Sketches of the A and B circuits referred to by James J. Brown*



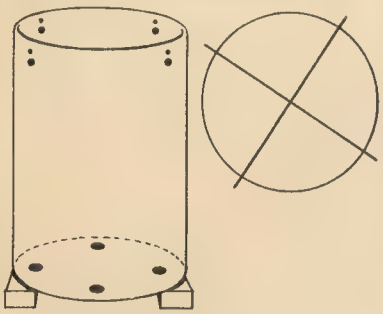



# POSTBAG . . .

two ¼ in. bars—just longer than the dia. of the drum—constitutes the charcoal burner.

Stand the drum, with the four holes downward, on bricks, light a good wood fire in the bottom of the drum, about 6 in. thick, and let it take good hold. Have on hand a supply of wood you wish to carbonise, which should be about 4 in. shorter in length than the inside of the drum, and about 3 in. dia.

As soon as you are satisfied that the fire is well away put the wood into the drum much in the manner in that



*The charcoal burner which is described by Mr Stead*

asparagus is tinned. The timber will protrude. Let the fire get a good hold on this and in 15 to 30 min. knock down these pieces until they are below the level of the four inward protruding screws.

Cover with the bottom you chiselled out and thread through diametrically opposite holes your two pieces of ¼ in. bar over the top of this bottom. Kick the whole lot over, so that the four holes are now at the top, and leave it. It will emit white smoke for a considerable while, and if you are passing it at any time give it a good shake or a few rocking kicks.

When the white smoke ceases put four little pieces of tin over the four holes and seal with a handful of clay. The bottom, also, where it rests on the ground should be well sealed with clay. Leave overnight and the next morning open and remove, over a 200 lb. size gunny bag, good quality charcoal; you will find the sticks are carbonised just as they were put in so you will have some really good big stuff.

If you cannot obtain lengths of timber about 3 in. dia.—we use tree branches—try to get any odd pieces cut from the ends of building lumber, always remembering that only the heaviest timbers should be used, i.e. oak or similar material.

MODEL ENGINEER

The charcoal is only the carbonised wood so a light wood will produce a light, open-pored, fast-burning and very ashy charcoal. Heavy timbers produce heavy charcoal.

The method may sound involved, but it is really simple and effective; I believe it originated in Australia and was used to make charcoal for gas burning engines during the 1914/18 war.

Tanganyika, E. Africa. R. G. STEAD.

## DREDGING PAIRS

SIR,—The photographs below are of two Fowler ploughing engines engaged on dredging Gledhow Park Lake, Leeds. They were taken shortly after the arrival of the pair last May.

It would appear that these are the two observed by D. W. Mitchell [Postbag, May 24] working at Grassington; a friend of mine saw them on the way to Leeds. No 15222 has registration number CT 4289, and No 15529 bears EJW 510; they are rated at 16 h.p., and were made in 1918.

These engines were referred to by R. T. Maughfling [Postbag, September 13]. Rev. P. A. Wright stated [MODEL ENGINEER, September 27 and October 4] that the owners, Messrs J. B. Carr of Tettenhall, Wolverhampton, have seven similar sets.

One wonders how this type of work will be carried out when all these fine machines have, alas, gone to the scrap-heap.

Leeds 15. DONATI O. WHITEHEAD.

## WEAR ON BEARINGS

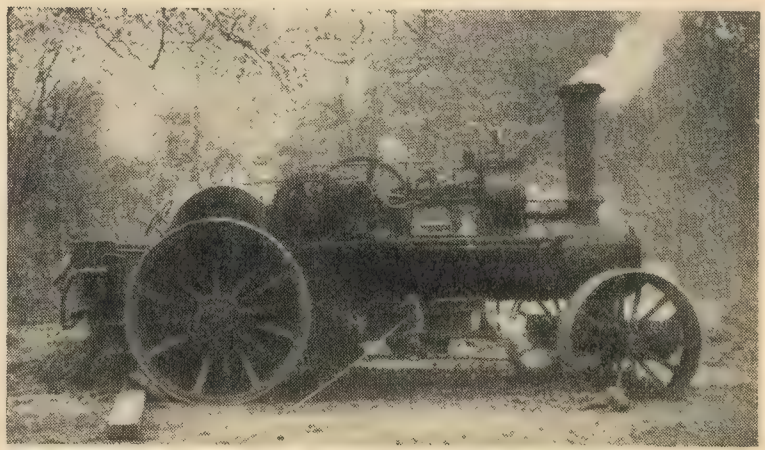
SIR,—With regard to the last paragraph of F. J. Camm's letter [Postbag, December 13] on bearing materials, I think he will find that more wear occurs on the harder shaft owing to particles of foreign matter becoming embedded in the softer bearing material causing it to act as a charged lap.

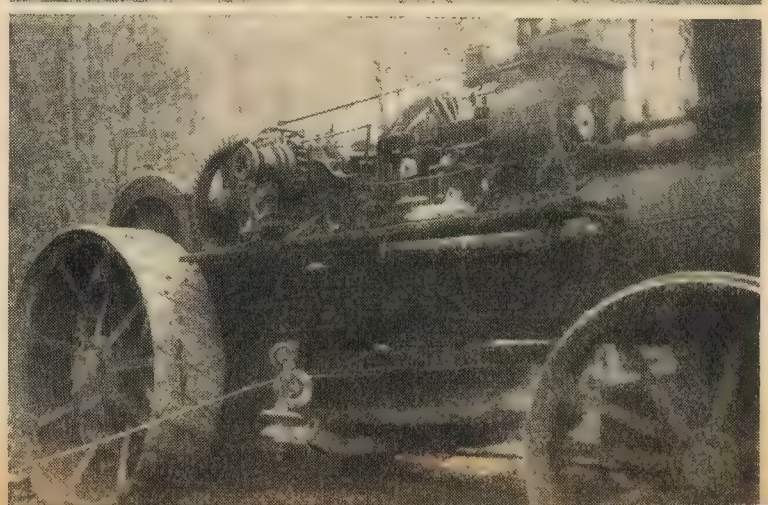
He refers to a mild-steel shaft and bearing both becoming worn; a far more probable result would be a seizure. This is caused by part molecules in the bush linking up with part molecules in the shaft causing many tiny spot welds. This is commonly known as "picking up."

It could not happen with the usual dissimilar materials used as they have different molecular structures.

Newport, Mon. B. J. WHITEHEAD.

*A wisp of smoke drifts lazily from the chimney of CT 4289, a Fowler engaged on dredging duty with its companion at Gledhow Park Lake, Leeds*





## IN SUEZ

SIR,—I was interested to read Mr Villiers's article on the Suez Canal in the December issue of *Ships and Ship Models*, as my unit was engaged in the recent fighting there.

During my stay I was part of a patrol in "Shanty Town" which borders the "Basin Industrial" and I saw quite a number of wooden sailing ships, of the type illustrated on page 379, under various stages of construction. Workmanship was comparatively crude but the boats were all finished in very gay colours.

Several small naval vessels were also in the Basin, but most of these had been sunk by our aircraft.

B.F.P.O. 51. M. FARDELL.

## THE LARGEST

SIR,—I am enclosing a photograph of a new Japanese-built ship. It shows the *Devon*, the latest and largest of a number of dry cargo vessels with engines and superstructures right aft which have been constructed in Japanese yards for Liberian-Greek interests.

Built by Mitsubishi Heavy Industries at Hiroshima, she is owned by Villanueva Cia. Nav., one of the Goulandris companies. She measures 10,545 tons gross on a length of 503 ft, and on her maiden voyage lifted a record cargo of 14,350 tons of wheat at Vancouver, loaded in three working days.

London, S.E.15. ALEX DUNCAN.

## CUTTER ENSIGN

SIR,—In reply to the letter from Mr C. Codner [*Ships and Ship Models*, November] I would point out that the Blue Ensign (and blue pendant) defaced with the *castellated gateway* is correct for a revenue cutter of *circa* 1810, in accordance with the Act of 1784.

This required a Custom House vessel, giving chase, to hoist a *blue* Customs ensign and pendant (previously it had been red) "with the marks now used," i.e, the gateway. Mr Codner has confused this design with the modern Customs ensign, which is blue but with a yellow crown and *portcullis*.

From 1817 the Customs ensign was red, with a crown in the fly; in 1864, when the revision of the uses of the ensigns took place, the colour should have been changed to blue, in common with other public services ensigns and jacks, but this was not done until 1872, when the attention of the Admiralty was drawn to the matter, and H.M. Customs consequently had to fall into line with other public services.

Brundall, Norwich. ALEC A. PURVES.

## MAILBOAT

**Letters with a nautical flavour and those held over from the last issue of *Ships and Ship Models* have a page of their own in this issue**

## THE "LOCH ARD"

SIR,—I am considering painting a picture in oils of the ship *Loch Ard*, and I am wondering if any reader has any information about it or could tell me where I could find a drawing or illustration of the ship.

This vessel was in the immigrant trade to Australia about 1870-80 and was wrecked off Sydney heads I believe, and her anchor is preserved in a public park in Sydney.

The painting is wanted by a woman who remembers the chief steward on this ship.

Northampton. F. J. ROCHE.

## USE OF PLASTIC KIT

SIR,—I have just read Mr Christopher Walker's letter [September *Ships and Ship Models*]. I agree with Mr Walker that a larger size than 100 ft to 1 in. should be used for a first attempt.

A further suggestion I would put forward is that, as a preliminary to building a first attempt one of the excellent plastic kits, i.e., Revell, should be painted and assembled.

As an example I have in mind the Matson freighter *Hawaiian Pilot* of this series. Very little fitting work is required but it is a wonderful exercise in the art of painting, and the very detailed instruction sheets give a good idea as to the best order of assembly for the parts of one's own model.

These kits also give an excellent idea of the amount of detail which can be safely included without showing signs of overcrowding.

I might add that my interest in building ship models was originally fired by seeing one of these plastic kits which at the moment I use as a comparison and yardstick for my own models.

Kenilworth, Warks. P. M. DOWNES.

## SQUARE-RIGGED YACHTS

SIR,—I am at present working on a book devoted to the square-rigged yachts of the turn of the century, of which there were more than is I think supposed. I am anxious to obtain photographs and/or data on the subject, and would be very grateful to any reader who may be able to help.

Any material loaned would be photographed and immediately returned to the sender, and not retained until the completion of the work, while any assistance would of course be acknowledged in the final production.

Glasgow, S.W.1. H. A. UNDERHILL.

## LONE WOLF

SIR,—As I am perhaps a lone wolf in Algiers, I should be very glad to meet other ship modellers in the neighbourhood for the exchanging of pictures and ideas.

I am mostly interested in British warships and merchant ships. In 30 years I have built many waterline models at 1/500 scale, which is very near the British scale of 1/50 in. to 1 ft.

Alger, Algeria. DR COSSET.

*The* DEVON, *the largest dry cargo vessel built in Japanese yards*

# A ship modeller's diary

## By JASON

THE surroundings may be strange, but we are among friends. So on behalf of my many colleagues welcome to this new corner. In passing, we ship modellers have been guests here before—first, at the beginning of the century up to the first issue of the old *Ships and Ship Models* in 1931, and then during and after the second world war until the publication of *Model Ships and Power Boats*.

The policy is still the same and can be summed up in half a dozen words: "Get interested; get together and get busy." I'm for the beginner and I'm for the lone wolf. If, however, the lone wolf prefers to remain a lone wolf his reasons must be respected.

**New societies**

QUITE a sizeable pack of lone wolves has written to me. I find that about 90 per cent. of these wolves are within reach of established clubs or are in an area capable of sustaining a flourishing society. For example, Mr L. R. Armstrong of Westgate, Kent. He may or may not be aware that Margate has a society which would welcome him for his 25 years' experience of working models, both power and sail. Indeed I think Mr Armstrong would be more than welcome for he is a designer as well. He does not say if he is a lone wolf, and that is why I await further information. But I feel sure that he would be willing to meet lone wolves in the Margate area.

* * *

Many years ago I knew a Liverpool member who was blessed with a large family. *He used them to masticate brown paper.* Mixed with flour and water he applied it to a former. It set like a brick and was amenable to abrasives.

A post card from Mr Percival tells me he is proposing to use papier mâché for the hull of a Thames barge. Mr Percival is a Northampton modeller and presumably is a lone wolf. If any Northampton modellers care to drop me a line I'll put them in touch with Mr Percival, for his town should easily support a ship model club. I'll go further, I'll try and be present at their first meeting.

Mr Murray of Roath, Cardiff, is a lone wolf, yet the Cardiff Ship Model Society has a couple of Championship Cup winners. He is a cinema projectionist and, of course, he works every night. But what about Sunday mornings? His liking is for warships, particularly *Graf Spee*. That fine modeller and naval architect, Leaske—he died shortly after the war—was particularly proud of the body plans of *Graf Spee*; he showed them to me *before the war*. They were not official, of course, but I don't think that they could have been far out.

**Windjammer men**

IF you're interested in windjammers my next lone wolf will certainly appeal to you. He has some interest in the clippers, even as far back as the Western Ocean packets, but his real interest is in the windjammers and in this direction I know of no one who has more pictures of them, nor who has more knowledge of them.

If, therefore, you are engaged on a windjammer and are puzzled on some problem, connect with Mr Richard M. Cookson, Rooms 169-170, Cranborne Hostel, Cranborne, Southern Rhodesia. Be sure you give sufficient details to recognise the ship and be sure to enclose an envelope and reply coupon. Mr Cookson's many friends will wish him well in his new career overseas especially those in Preston and North London. For many years now he has been keenly interested in the grain carriers. On occasions he has even dashed to Falmouth to board one and finish the voyage—usually to the home port of the Erikson ships—in Marieheim, Finland.

* * *

Mr M. Morgan in Cambridge favours waterline models of coasters. I remember only a very few modellers in that area, but two more with Mr Morgan will ease his burden tremendously. Please don't leave it to the other fellow. It so happens that he's leaving it to you. All that is required is a postcard with your name and address and, if you like, a few remarks on your interest.

* * *

Master A. F. Squirrell from 86, Woodside Green, S.E.25, is completing a working model of a coaster. For his information the Greenwich S.M.S. meets every month in Charlton House. Write the secretary, 79, Delafield Road, Charlton. Closer still is the South London S.M.S. who will be glad to welcome him. Now for Rugby. This would, I think, be an excellent centre for a society. Mr Bowen is working on a couple of useful models, the famous tug *Turmoil* and an Esso tanker. He has definitely original views on several subjects and to save time if you live anywhere near Rugby drop him a line at 59, Faraday Road, Rugby.

**What about it, Slough?**

THERE are many organisations in Slough, but I don't think a ship model club exists there. During the past ten years I have looked at many models from this busy area and I have no doubt there is room for a very active society. Mr Creffield is particularly interested in radio-controlled warships and at present he is working on H.M.S. *Marvel* at one-eighth scale. Mr J. W Goss of Bedhampton, Havant, Hants, at 50 ft to 1 in. follows the scale made popular by Donald McNarry and he displays a nice choice of subject. His two models now in construction are the French cruiser *Colbert* and the Dutch whale factory ship *Willem Barendsz*.

* * *

Mr D. G. West of 185a, Bedford Hill, Balham, South London, is a lone wolf—even in Balham. The old S.W. Society has moved south and east *and out*. South London is a long way, but I think it could be worth it once a month. Meanwhile other lone wolves in the area please contact direct.

* * *

Mr F. W. Dunham of the Hatfield and District Society of Model Engineers *describes* himself as a lone wolf. He is the only ship modeller in a crowd of engineers, yet he admits to radio-controlled steam propulsion power boats. He is not so badly off as some. Nevertheless he'd like to get in touch with some ship modellers nearby. Incidentally the powerful Sheffield Ship Model Society had its inception in similar circumstances.

* * *

All secretaries of established societies please note that routine reports should be sent to the Clubman and not to me. Future events will be noted in The Diary. I shall be glad to hear from lone wolves and will endeavour to get new societies for ship modelling going in suitable centres. I'm aiming at Leicester, South Manchester, Rugby, Slough, Northampton and Blackpool. If half are going by early summer, I'll be content. ▣

# ★ ★ ★ CLUB NEWS ★ ★ ★

## Edited by THE CLUBMAN

*My ship is my delight,*
*I made her, she is mine,*
*I built her trim and tight,*
*I dreamed her gracious line;*
*No wooden thing is she*
*But some proud part of me;*
*I made her, she is mine.*

**THE WORDS are Sir Alan Herbert's, written for the great Captain Slocum. To whatever nautical tune they suggest, MODEL ENGINEER has pleasure in piping aboard the loyal readers of "Ships and Ship Models" which has ended its existence as a separate magazine—at the same time as the very old and famous "Chambers' Journal," which was read in every outpost of the Commonwealth and regarded by Scotsmen in all parts of the world as a structure hardly less permanent than the Scots Memorial in Edinburgh.**

We hope and believe that the readers of *Ships and Ship Models* will find a happy mooring in these pages. They come not as strangers but as old friends, an integral and important section of the great modelling movement, and they should feel as much at home in the parent magazine as they do every year at the M.E. Exhibition in London where their work adds distinction and grace to the array. Some of course are not modellers; but they too, we think, will find a good deal to interest them in a magazine whose scope is by no means narrow.

To the ship clubs and kindred organisations, this page in particular is already well known as it has incorporated their news from time to time. In inviting their reports and announcements, I would draw the attention of secretaries and press correspondents to the Open Letter published in MODEL ENGINEER of November 8. Reprints of this letter have been circulated and copies may also be obtained free direct from Noel Street.

### FIRST ABOARD

First up the gangway, so to speak, is a very young club, the **Leeds Model Boat Society.**

In a cheerful, detailed letter P.R.O. C. Parcell (5, Seaforth Avenue, Harehills, Leeds 9) tells me that this society, now four months old and steadily growing stronger in membership and interest, provides for all types of ship enthusiasts in Leeds and the neighbouring districts. They will, he says, be "most cordially welcomed" at the meetings held at 8 p.m. on alternate Thursdays in Church House, Church Row, a mere stone's throw from Leeds Parish Church.

The society is fortunate in having two very good sailing waters, Roundhay Park Upper Lake and Middleton Park, used by the members with the official permission (and blessing) of Leeds Parks Committee.

"Now that the dark days are with us again," continues Mr Parcell, "sailing is confined to Sunday mornings from approximately 10 a.m. till noon or after, depending on the weather. In the spring and summer we hope and intend to make the sailings all-day 'family-get-togethers'."

Through the kindness of the local model railway club in giving a stand at the exhibition held in the Corn Exchange, the L.M.B.S. was able to make its debut in October. Members exhibited various types of models, ranging from tugs to *Pathfinder* and including all types of launches, M.T.Bs., R.A.F. tenders and similar craft.

"Radio control is very strongly supported by a large majority, the rest being not *too* keen. This leads to some very interesting evenings.

"At the present time we are trying to find a room for our personal use in the 'practical' side whenever a member cares to drop in. So far we have had no response, but we live in the hope that in the near future we shall be more successful.

"The society is affiliated with the M.P.B.A., and we have adopted its little flag pendant as 'ours.' Anyone seeing this badge in Leeds or area is cordially invited to stop us and have a chat. He is most welcome to join us at any time," writes Mr Parcell.

### BIRMINGHAM SHOW

In celebration of a successful decade, the Midland Area of the **Stephenson Locomotive Society** is opening a railway exhibition in Birmingham on the last day of the old year. Between then and January 5 it should be seen by great numbers of the public—boys still excited by their own trains and fathers whose appetites have been whetted at the same Christmas source.

Coats of arms, photographs and other railway items are included, together with a comprehensive display of models; and **Birmingham Model Railway Club** will be there with its working layout. On certain evenings films are to be shown in an adjoining building.

"All model engineers are very welcome indeed," writes secretary W. A. Camwell, whose address is 16, Hutton Road, Handsworth, Birmingham 20. They will find the exhibition at the headquarters of the Royal Birmingham Society of Artists, 69a, New Street. For the benefit of strangers to Birmingham, these rooms are near Woolworths.

The show opens at 11 a.m. each day and closes at 9 p.m., except on the Saturday when the doors shut two hours earlier. The 1s. 6d. admission charge is a small sum to pay for a treat worthy of the S.L.S.

Since the Midland Area was established, with its centre in Birmingham, when the Midland and North Western Branch was split into its two components, the membership has increased from 112 to more than 460. It is still growing. In fact, interest was never greater than in 1955 when no fewer than 85 new members enrolled—a record for the whole 10 years.

Every reader of this page will wish the Midlanders not only a very successful exhibition, but also another decade of prosperity.

### M.E. DIARY

**January 5.**—Birmingham Railway Exhibition last day (closes 7 p.m.).

**January 8.**—Bristol S.M.C., "Reminiscences," E. C. Lowther, Legion House, 7 p.m.

**January 10.**—Liverpool Nautical Research Society, "Some Minor Mersey Ports," T. D. Tozer, 7.30 p.m.

**January 11.**—Welling and District M. and E.E.S., "Ship Models."

# Model Engineer

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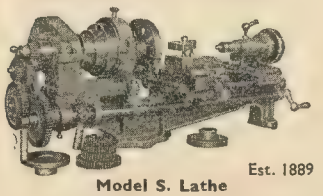

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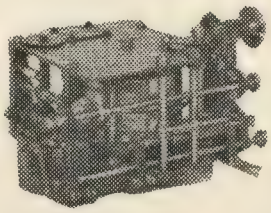

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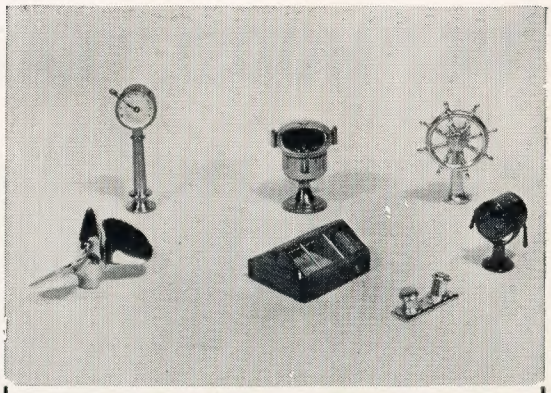

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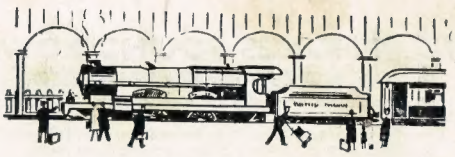

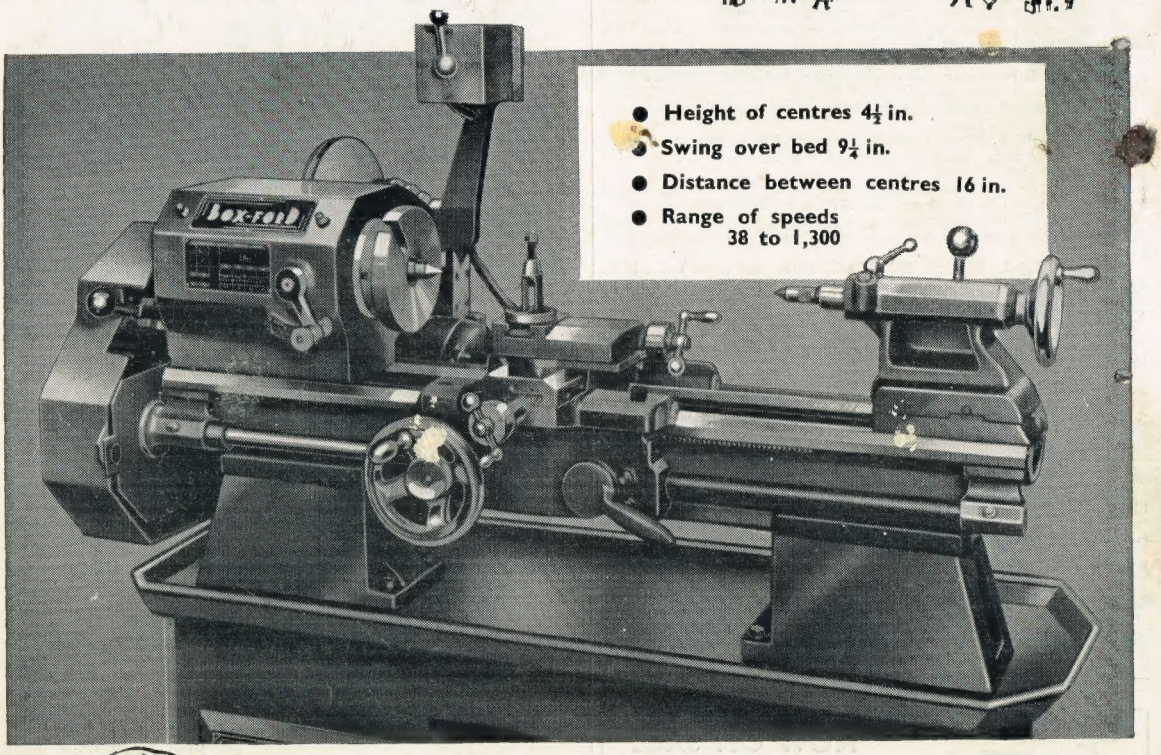

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